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# Shasta Dam Temperature Modification Value Engineering Study

September 4, 1987

Perry L. Johnson

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SHASTA DAM TEMPERATURE MODIFICATION
VALUE ENGINEERING STUDY
SEPTEMBER 1987

## INTRODUCTION

At the request of the Regional Director, Mid Pacific Region, a VE (Value Engineering) team was formed to investigate and develop alternative methods of controlling the temperature and turbidity of the releases from Shasta Reservoir. Shasta Dam as constructed is shown in plan and section on figure 1. These alternatives were to include a temperature modification screen similar to that proposed by CH2M-Hill to the State of California Department of Fish and Game.

A literature search was made in preparation for the VE study to determine existing concepts being used to select or modify reservoir discharges. During this search the U.S. Corps of Engineers, St. Louis office, Value Engineering Officer was contacted and requested to canvass the Corps' offices nationwide for information. Events leading from this inquiry resulted in a visit by a group of Reclamation engineers from Sacramento and the E&R (Engineering and Research) Center, to the Corps' WES (Waterways Experiment Station), in Vicksburg, Mississippi, to learn what the Corps has developed on reservoir outlet selective level and temperature and turbidity modification techniques.

The VE study was conducted during the week of September 21 through 25, 1987, in Sacramento, California. The value engineering team was composed of the following Reclamation employees:

| | | |
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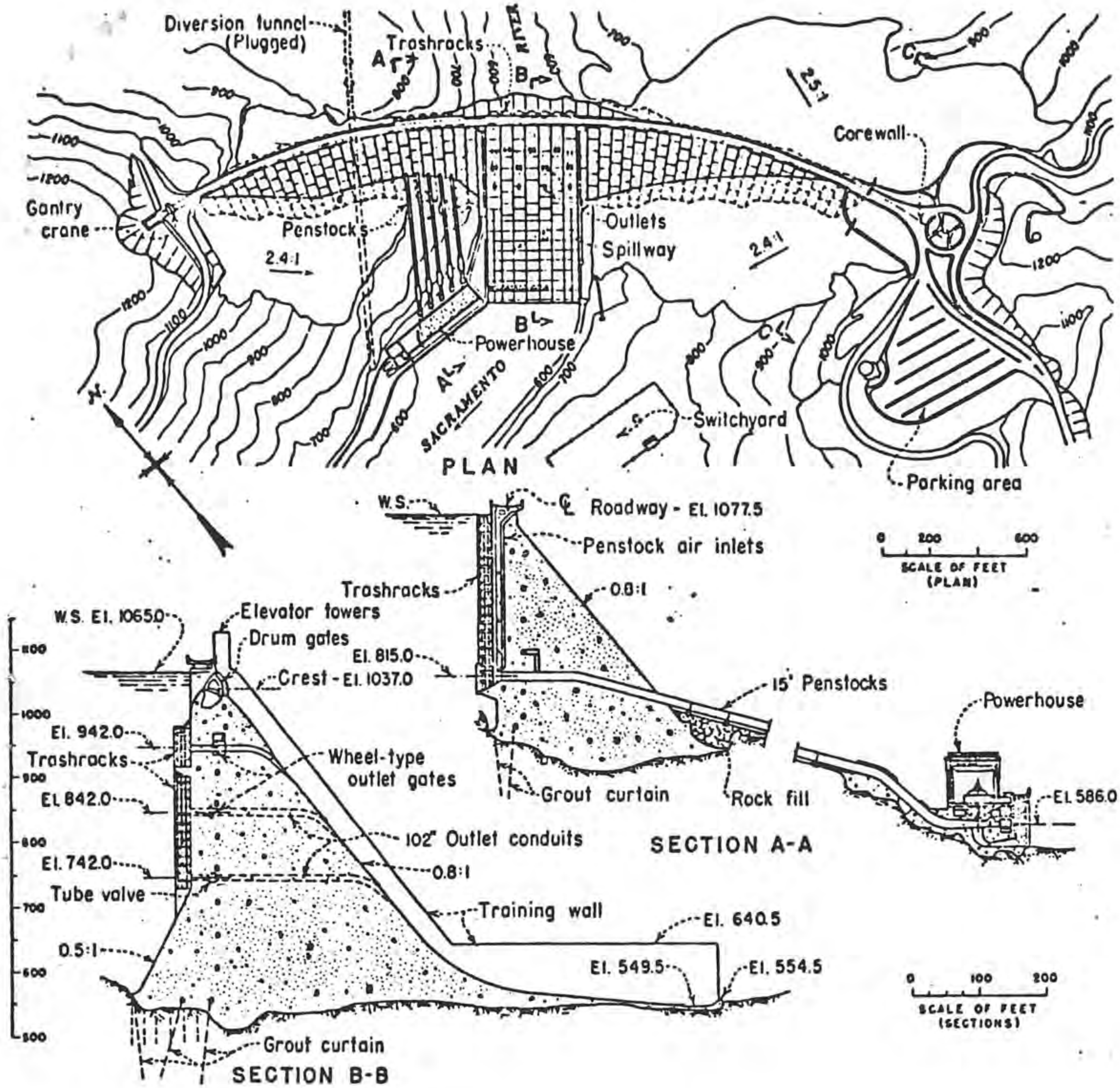
The VE team would like to acknowledge the assistance of the following persons for the information, advice, or consultation that they made available to the team during the course of the study:

Phil Sharpe
John Turner
Ken Jukkala
Rich Chelini
Paul Capener
Jim Romero
Jack Rowell
Susan Ramos
Al Jensen (FWS)




Shasta Dam—Plan and sections.

Figure 1

## RECOMMENDATIONS

1. Develop a basin-wide plan to optimize system operations to coordinate and control the temperature and turbidity of reservoir releases from the various facilities.

2. Utilize warmer reservoir waters which meet desired temperature (and to what extent possible, turbidity) criteria early in the season (January through May), thereby conserving cooler water for use later.

By conserving the available cold water, the number of years when reservoir operations must be altered can be reduced. This number can be determined during design using the existing mathematical temperature model of Shasta Reservoir. Preliminary runs with this mathematical model have been run and are attached as appendix 3.

These objectives can be met by either Option 3, Curtain-Type Temperature Modification Facility, or Option 4, Modify Existing Power Penstock Intake Towers.

Secondary benefits of turbidity control accrue from both the temperature curtain and modifications to the existing intake structure alternatives. The surface skimming process utilized by both options would withdraw the relatively less turbid water from the upper lake levels and provide additional settling time for lower level colloidal sediments. This would decrease turbidity of the releases during most months of most years. During dry years turbidity should be less throughout all levels of the lake and withdrawals from the lower levels, where turbidity is generally higher, should meet the proposed requirements.

It should be noted that these turbidity effects are projected but have not been accurately modeled. While they are expected to occur there are no guarantees that the proposed turbidity requirements will be met.

From the standpoint of temperature and turbidity control, and cost, the curtain concept appears to be the best alternative. This type facility of this size has never been attempted and many details and problems will require solution.

Option 4, although slightly more expensive, is a concept well within the range of experience and technology.

Modification to the existing intake structure should fulfill temperature requirements during most years and that frequency can be modeled with the aforementioned temperature model. If the study verifies the initial estimate, years when withdrawals from the lower levels are required will be minimal and so will be the associated costs.

A comparison of the costs of the various options is presented on table 2.

The VE team recommends the modification of the existing power penstock intake towers be adopted.

## THE PROBLEM

Reclamation has been requested to control the releases from Shasta Reservoir within specified temperature and turbidity ranges during certain times of the year. "Tentative Waste Discharge Requirements for Shasta Unit" as proposed by the California Regional Water Quality Control Board - Central Valley Region, is attached as Appendix 1. These turbidity requirements or some modification of them will govern Shasta Reservoir discharges. The temperature of reservoir releases would be managed in an effort to enhance the fall and winter salmon runs in the Sacramento River. Turbidity of reservoir releases would be managed to minimize the treatment requirements for downstream domestic water withdrawals from the Sacramento River.

The VE team developed a FAST (Function Analysis Technique) diagram of the reservoir release problem, attached as figure 2.

Figures 3 and 4 present the timing and duration of the various fish runs in the Sacramento River below Shasta Dam and the preferred water temperatures associated with these runs.

Figures 5 and 6 present observed temperature profiles from Shasta Reservoir in 1976 (a low water year), and 1979 (a high water year), respectively. These profiles were considered representative of typical years and were used to guide concept development. It was noted that detailed concept development should include careful evaluation of concept performance over a broad range of reservoir conditions. A mathematical model of temperature and turbidity within Shasta Reservoir would provide this information.

Figure 7 presents turbidity data observed 40 m above the bottom of the reservoir in 1983 and 1984. The vertical position 40 m above the bottom is well below the elevation of the power intakes and thus is likely not influenced by the clearing influences of power releases. The turbidity levels thus show increases due to storm events and decreases primarily due to settling. These data thus give an indication of turbidity reduction that could be achieved by retaining the turbid water in the reservoir. It should be noted that the 1983 and 1984 storm events were relatively small as compared to a few major events that have occurred in the past. Indications are that the major storm events yield much larger turbidity increases that may, at least in the short run, overwhelm any turbidity control efforts.

It should be noted that the temperature and turbidity data bases from which the VE team worked, the analytical capabilities of the VE team, and the time available to the VE team were all quite limited. Consequently, concepts proposed are definitely conceptual. Details of the design and workability over the full potential range of reservoir conditions should be studied

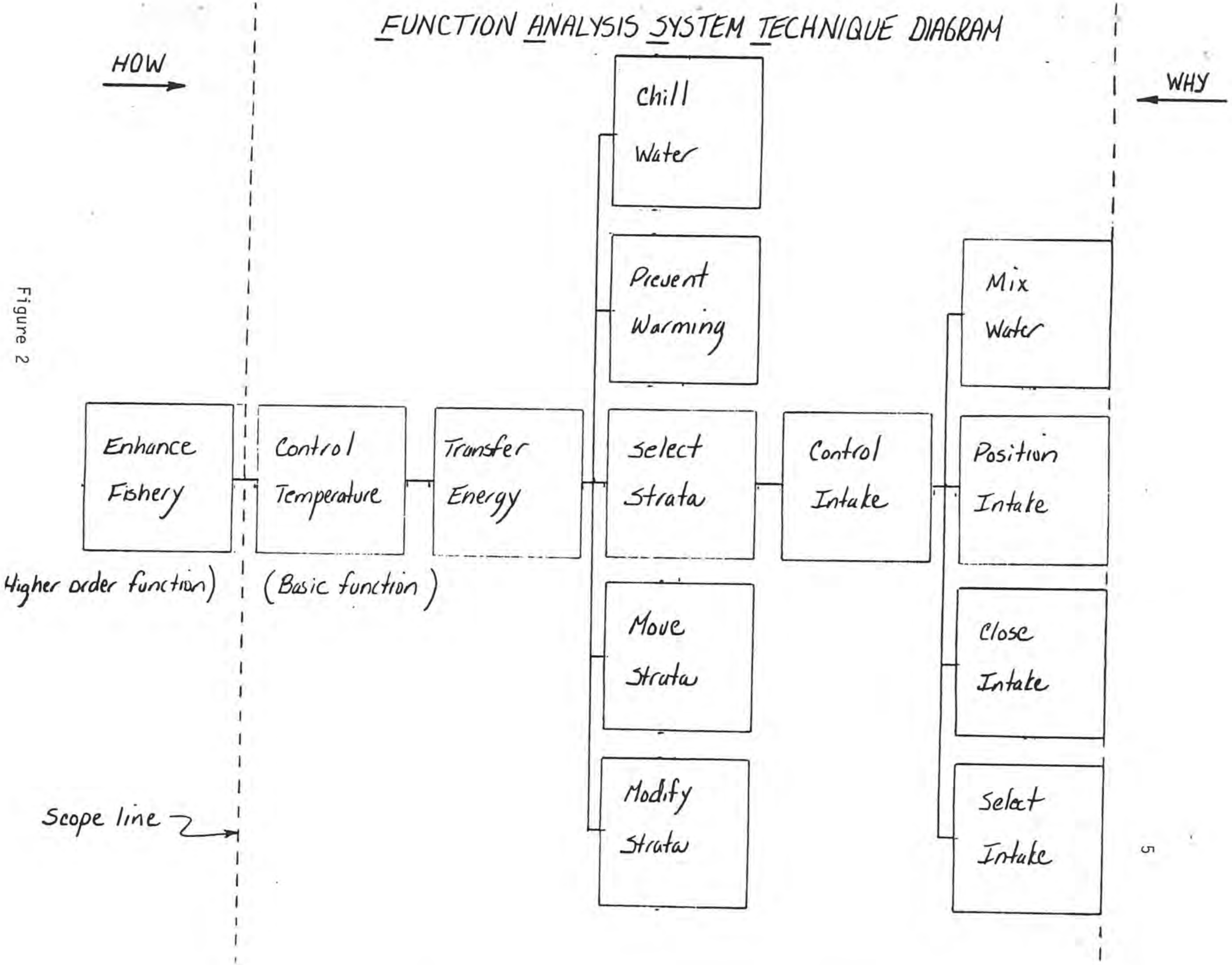
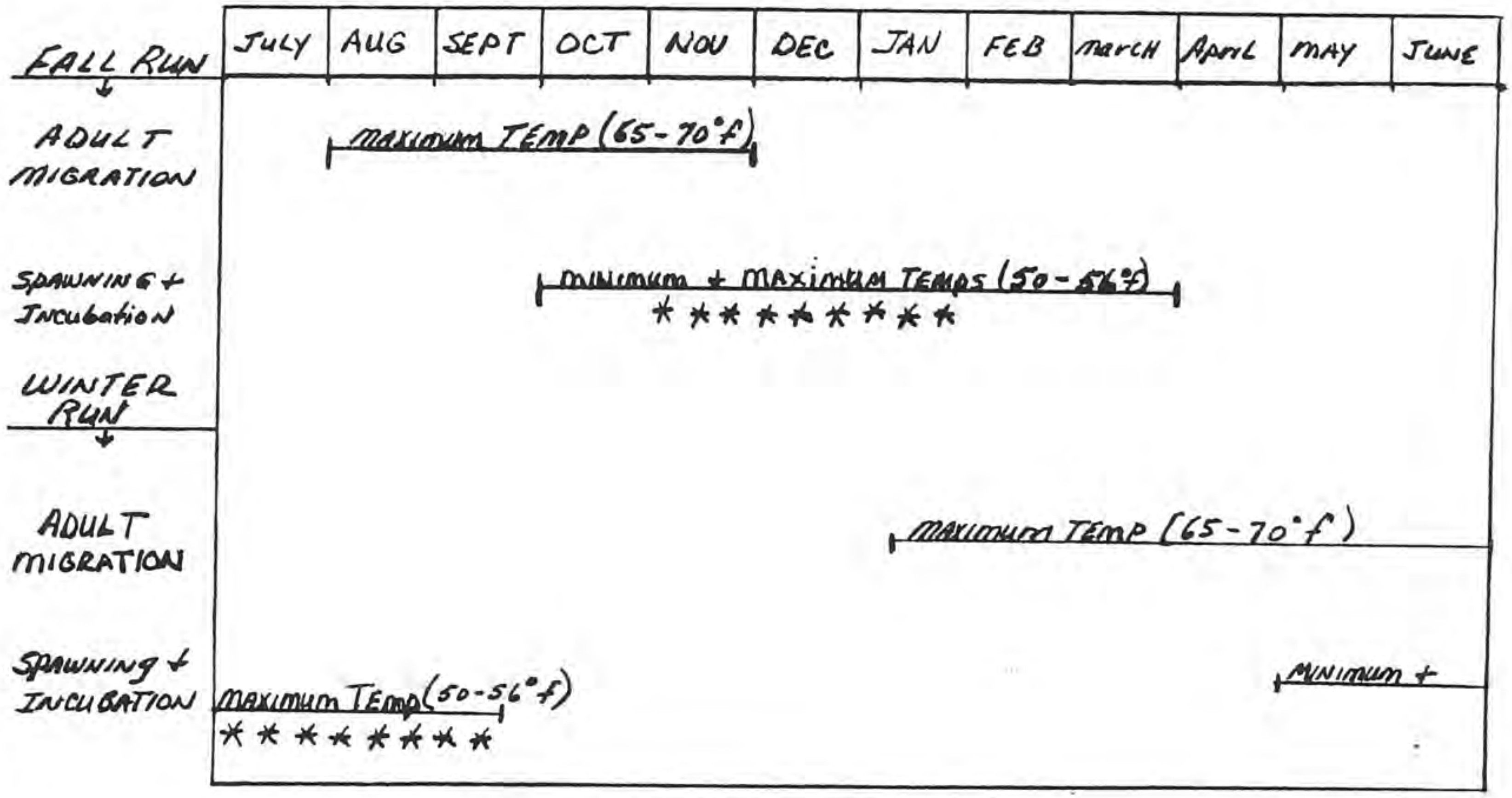

FUNCTION ANALYSIS SYSTEM TECHNIQUE DIAGRAM
HOW
WHY
Enhance Fishery
Higher order function)
Control Temperature
(Basic function)
Transfer Energy
Chill Water
Prevent Warming
Select Strata
Move Strata
Modify Strata
Control Intake
Mix Water
Position Intake
Close Intake
Select Intake
Scope line

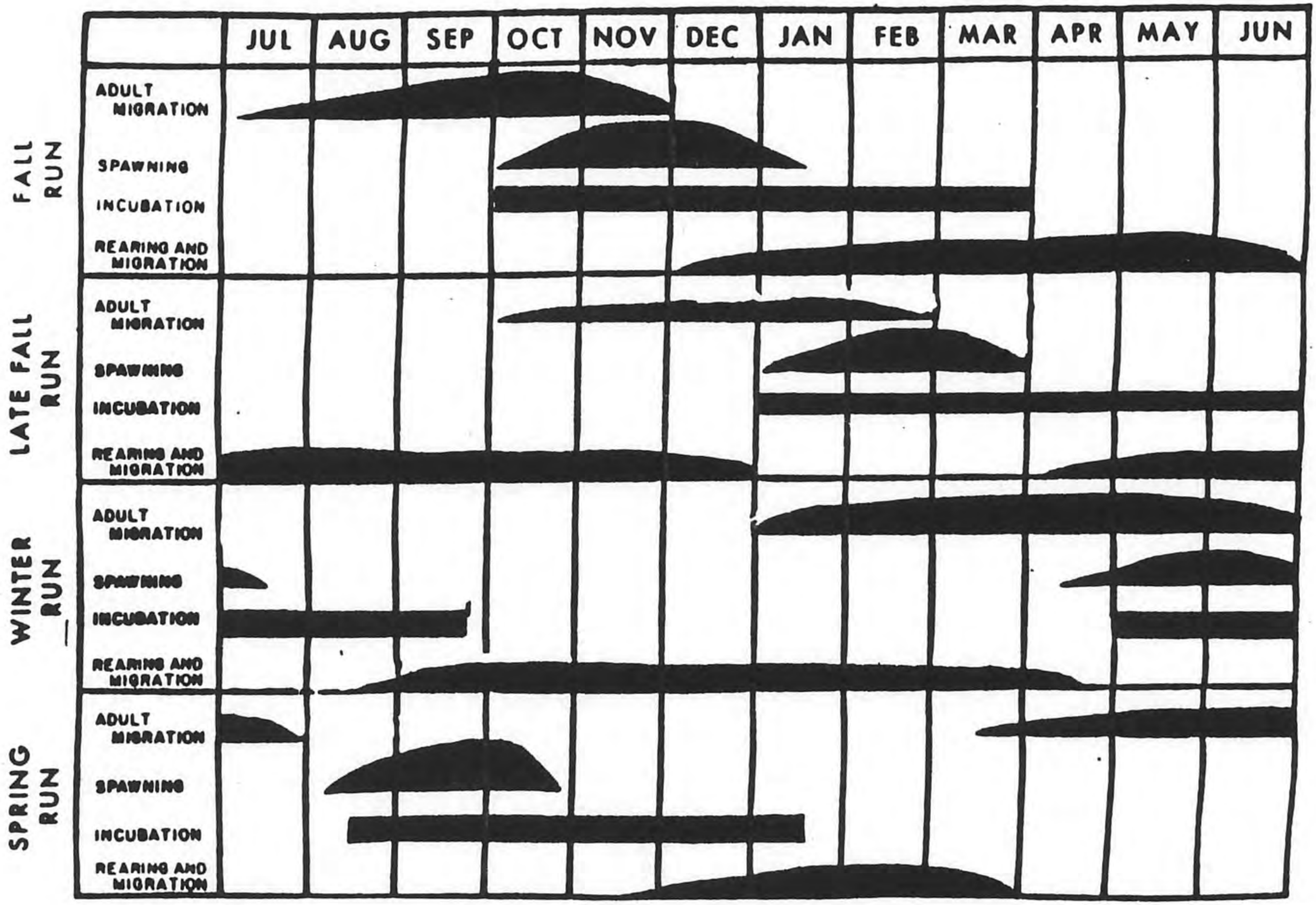
Figure 2

OPTIMUM TEMPERATURES FOR FALL + WINTER RUN CHINOOK SPAWNING, INCUBATION, AND ADULT MIGRATION




* Denotes a potential conflict between the probable temperature releases and required temperature for fisheries. The conflict is primarily due to ambient air temperatures and water supply and can be minimized through conservation of identified temperature strata and selective withdrawal.

Figure 3
Preferred Water Temperatures and Timing in the Sacramento River




Life history characteristics of chinook salmon in the Central Valley

Figure 4
Timing and Duration of Salmon Runs in the Sacramento River

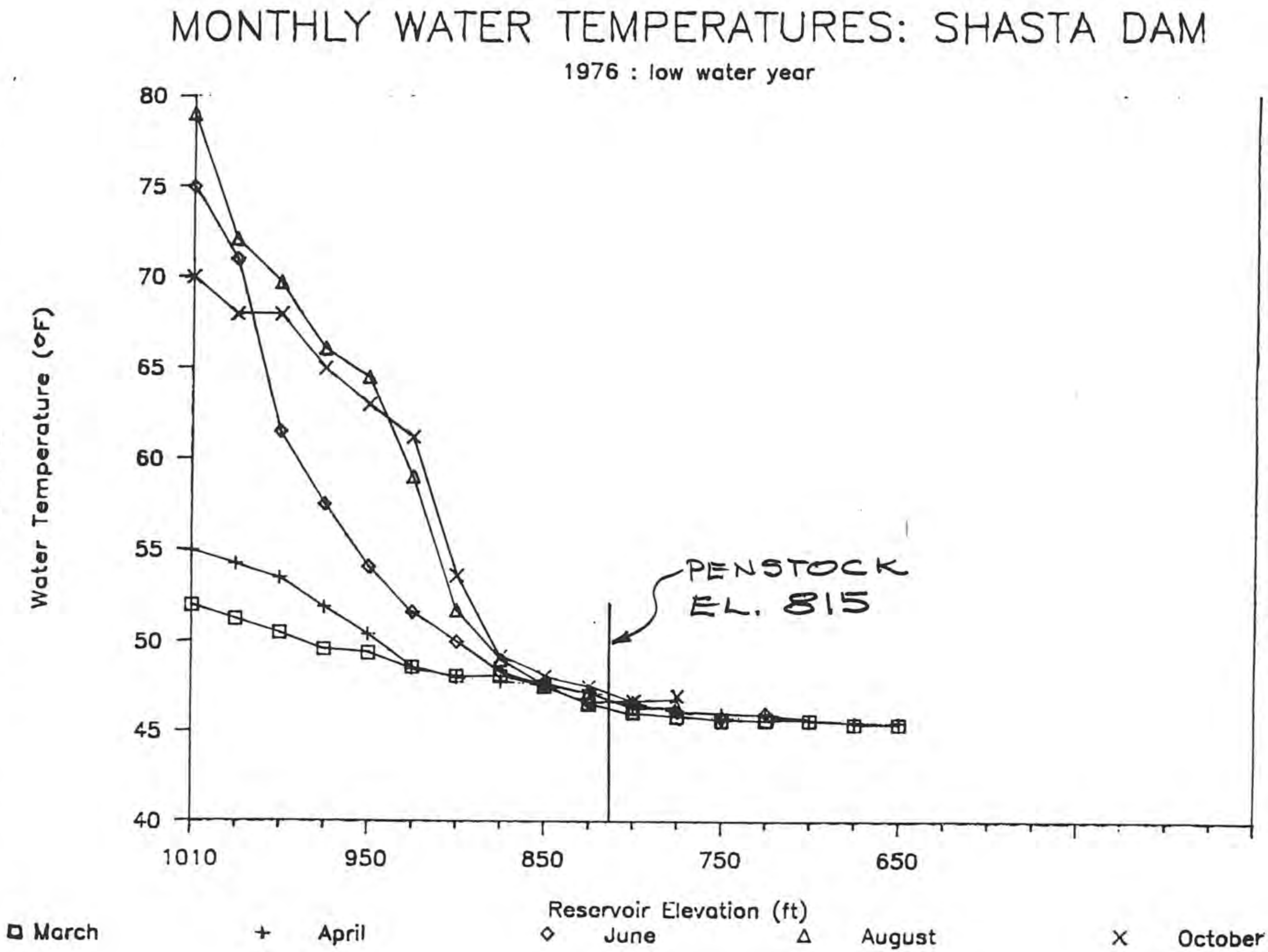



Figure 5

Observed Temperature Profiles From Shasta Reservoir, 1976, A Low Water Year

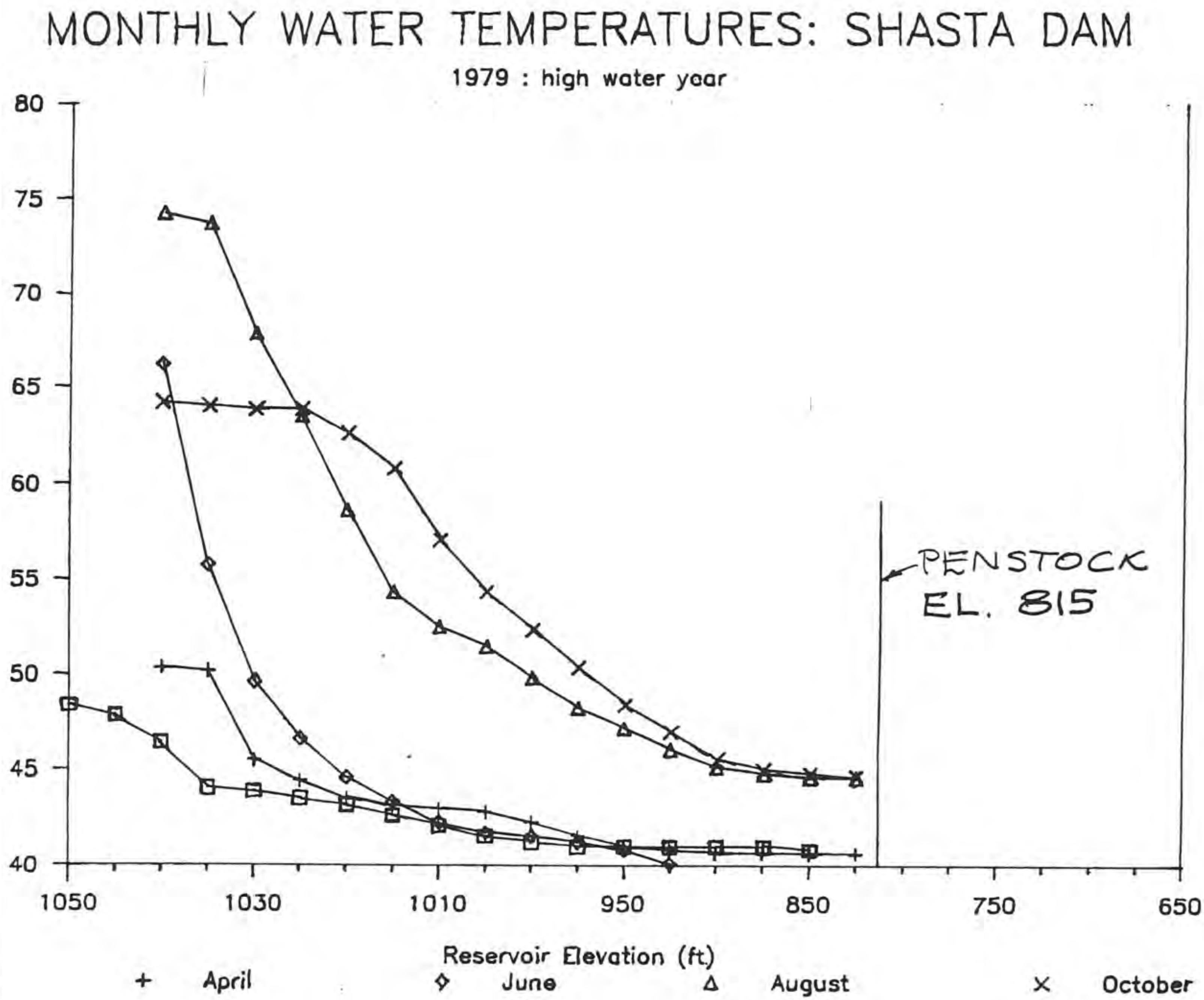
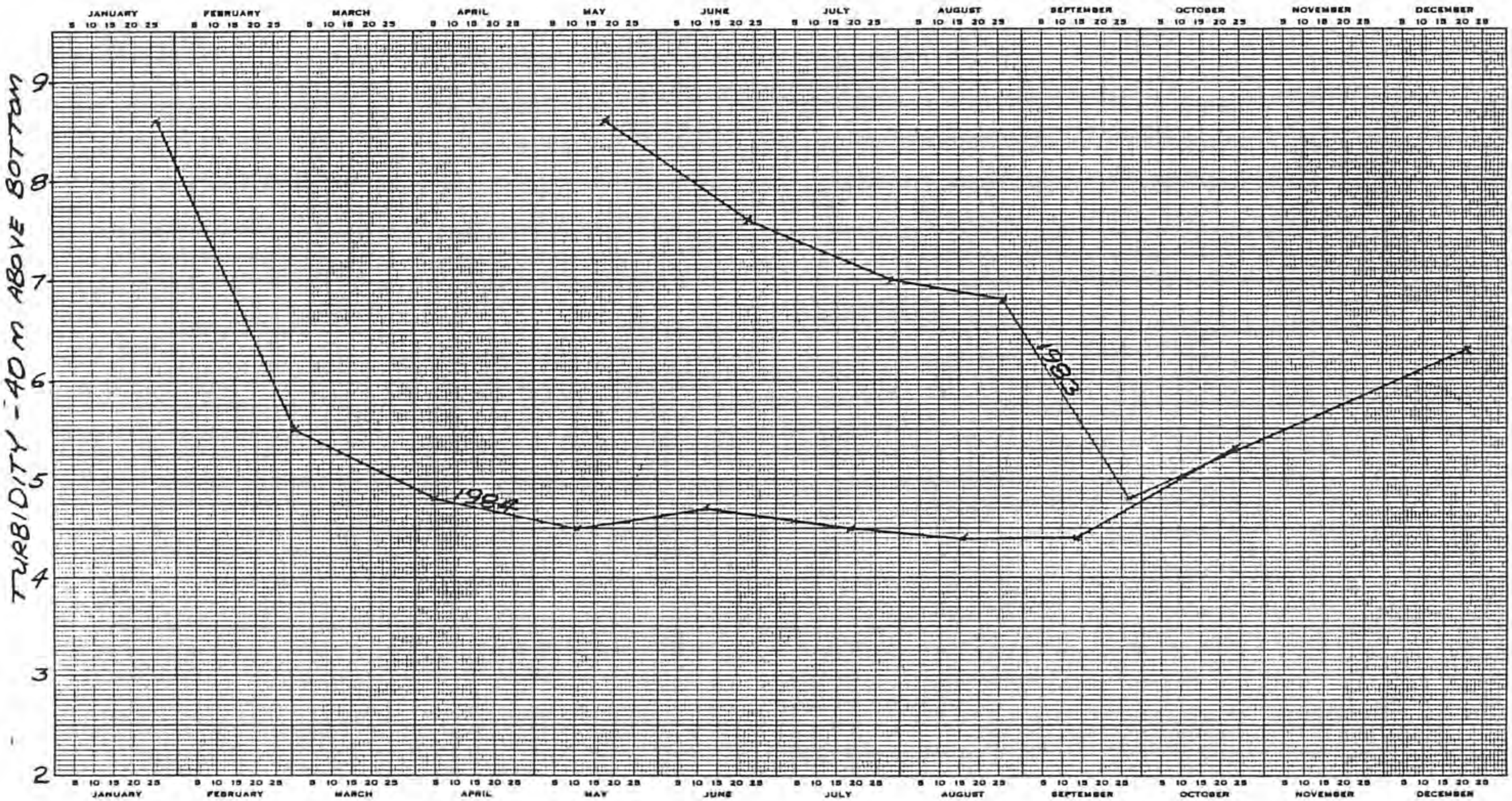



Figure 6
Observed Temperature Profiles From Shasta Reservoir, 1979, a High Water Year




Turbidity Observed 40 m Above the Bottom of Shasta Reservoir
in 1983 and 1984 (Parts Per Million)

Figure 7

be studied through more detailed analysis and through use of a mathematical reservoir simulation model. A series of preliminary mathematical reservoir simulation models were run in Sacramento during the review of this report to provide an indication of the effectiveness of the VE team's proposals on modification of reservoir release temperatures. These models are attached as appendix 3.

Desired Reservoir Discharge Procedures

A comparison of figures 3, 4, 5, and 6 indicates that early season discharges (January through May) if confined to the warmer surface zones of the reservoir, will meet desired temperature criteria until about June. It will also yield retention of turbid water with corresponding turbidity reductions due to settling. The restriction of discharges to the upper zone of the reservoir will tend to delay use of the cooler water in the lower reservoir strata. This will conserve it for use later in the summer when water of this temperature is needed to satisfy fishery water temperature requirements. It is anticipated that this operational scheme should successfully satisfy reservoir release temperature requirements for the majority of years. However, during extreme low water years (when water surface elevations drop below approximately El. 875) early season surface water withdrawal cannot assure late season cold water. When water surfaces are low, withdrawal from deeper in the reservoir, be it by modification at the power intakes, or use of the elevation 742 outlets will be required. It is expected that this would be a fairly rare occurrence.

Surface zone releases, in addition to the conservation of cooler reservoir water, will also provide less turbid releases during the early part of the year. The turbidity of withdrawals can be expected to increase as lower level releases are made for temperature modification. As stated in the Tentative Waste Discharge Requirements (Appendix 1), however, temperature would take priority over turbidity in cases where the objectives for the two parameters conflict.

A basin-wide plan to optimize all system operations to coordinate and control the temperature of releases from the various reservoirs to provide preferred optimum river temperatures for fishery purposes should be studied. A similar plan to address turbidity considerations likewise would be desirable. It may be that through smaller, less expensive modifications (both structural and operational) at several sites, optimum solutions can be found.

Evaluation of these operational and other nonstructual concepts should be carefully made before selecting a modification scheme for Shasta Dam.

Previous Reservoir Release Temperature Modification Proposal

CH2M-Hill presented a conceptual design for a temporary temperature modification screen in a report to the State of California Department of Fish and Game entitled, "Conceptual Design, Shasta Dam Emergency Temperature Control," May 1977. This concept is shown on figure 8. The estimated cost for this concept ranged from \$516,400 to \$691,400 (1977 prices depending on the type of support structure required.

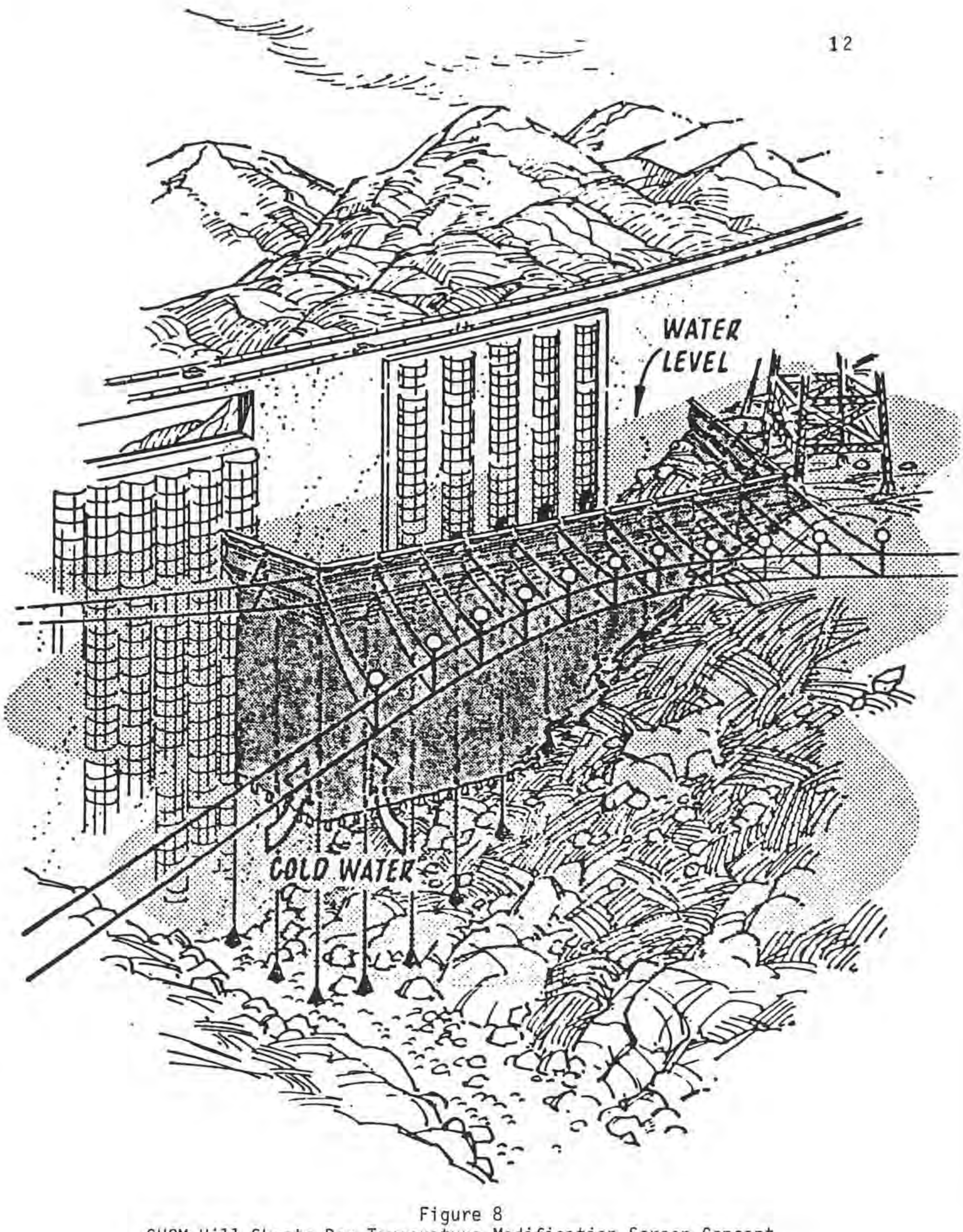



Figure 8
CH2M Hill Shasta Dam Temperature Modification Screen Concept
From "Conceptual Design, Shasta Dam Emergency Temperature Control,"
May 1977

The proposal consisted of a series of reinforced Hypalon curtains installed upstream of the face from Shasta Dam in such a manner as to prevent the warm surface water of the reservoir from entering the penstocks and to draw on the cold water from the lower reaches of the reservoir. This curtain concept was proposed to be installed on a temporary basis for the months of October and November 1977 only, and was primarily designed for the drought conditions existing at that time. The concept as presented has little operational flexibility.

VE Team Deliberations

Several alternatives were formulated and evaluated by the VE team, and these alternatives are briefly discussed below:

Alternative 1. Typical Selective Level Intake. - This alternative would involve the construction of a tower or towers on the face of the dam. Intake apertures at various levels with flow control devices such as shutters would allow the selection of reservoir waters from different elevations within the reservoir. This selective level intake tower concept has been used by Reclamation and others.

Due to the location of the penstock intakes and reservoir bottom configuration in the vicinity, it will be impossible to tap the lower strata of the reservoir directly. Combining an underwater conduit (elephant trunk) or an underwater power thruster similar to alternatives 2 and 3, below, with the selective level intake would tap this lower water strata when required in low water zones. This would allow movement of colder water from the lower strata of the reservoir to the penstock intakes. Construction of a new tower would be expensive and would require additional facilities such as alternatives 2 and/or 3 to provide cold water during low water years.

Either the elephant trunk or underwater power thruster (alternatives 2 and 3, below) would be difficult and expensive to install and operate due to the depths of reservoir water in the reservoir area where they would be installed as shown on figure 9.

Alternative 2. Underwater Power Thruster. - The VE team discussed the use of an underwater fan or thrust mechanism in a conduit to lift cold water from the lower reservoir reaches to the immediate vicinity of the penstock intakes. This concept could be used with the existing penstock intake configuration or in conjunction with alternative 1, above. A similar concept without a submerged power source, has been used by the Corps of Engineers and TVA (Tennessee Valley Authority). This concept is illustrated in conjunction with alternative 3 (elephant trunk) on figure 9.

Alternative 3. Elephant Trunk. A conduit extending from the cooler water strata in the bottom of the resevoir to the existing power penstock intakes (an elephant trunk) was discussed by the VE team. This concept in one form or another has been used by the Corps of Engineers. This

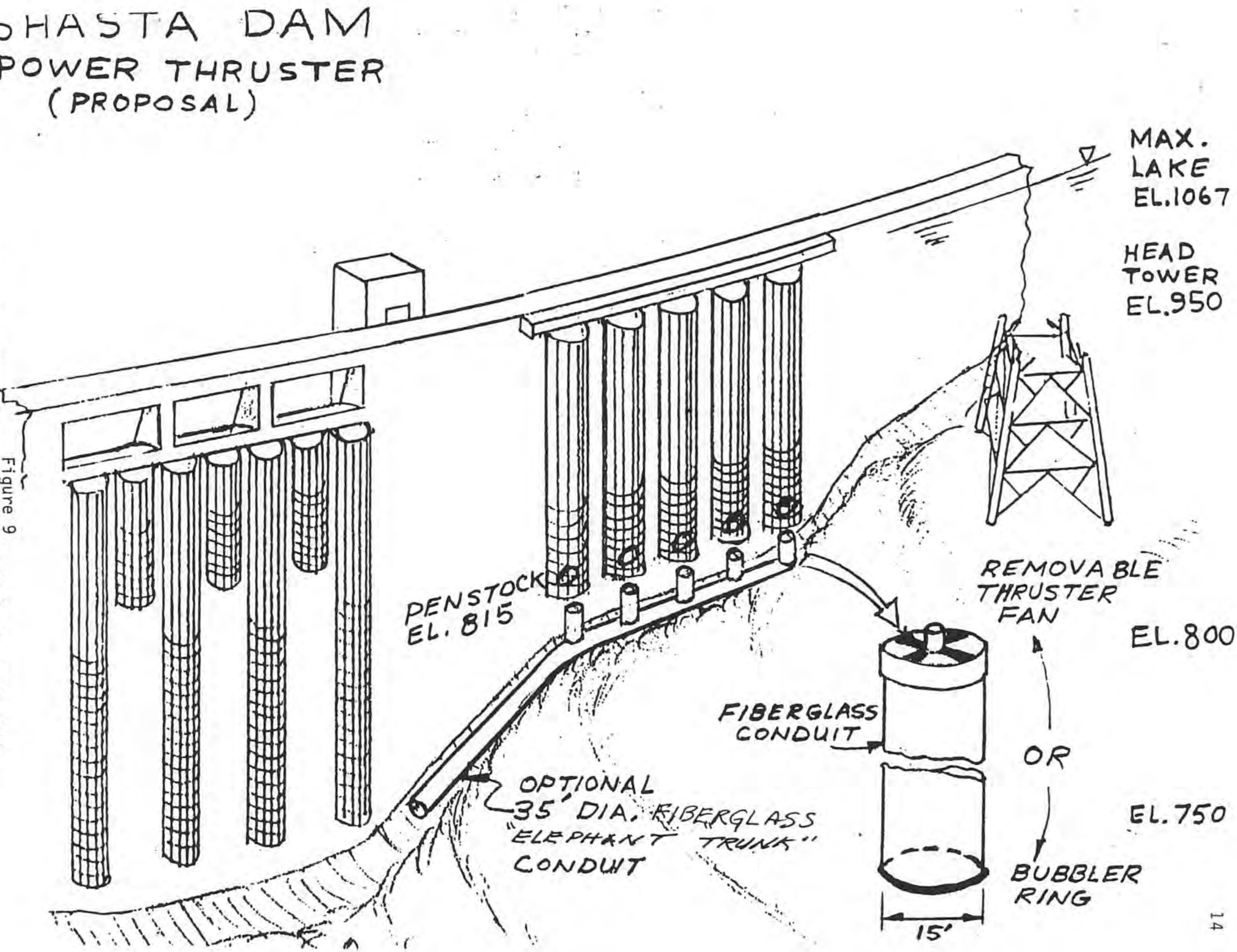



Figure 9
Underwater Power Thruster Concept in Conjunction With

concept could also be used in conjunction with alternative 1, above. This concept is also shown on figure 9. The use of the elephant trunk alone would involve the use of vertical stub conduits without the power thrusters as shown on figure 9.

Alternative 4. Turbine(s) Installed in River Outlets. - The installation of a Francis turbine in one or more of the existing low-level reservoir outlets, as shown on figure 10, has been suggested by Regional Power Operation personnel. A technical discussion of design and other considerations connected with this concept is attached as appendix 2. These comments are the result of a review of the VE team proposal by an E&R Center turbine designer.

Alternative 5. Reservoir Operational Management. - This past operation season, reservoir releases were successfully made through the lower river outlets to provide lower temperature water for the fishery. This water use precluded its passage through the powerplant with an accompanying loss in power revenues. A comment received during the report review process mentioned that it may be more cost effective to provide a bifurcation; one branch remaining as a river outlet, with the other branch connected to an existing penstock and turbine. This would permit low level discharges through the powerplant (avoids power revenue losses) while allowing low level (cooler water) releases from the reservoir. The VE team did not have sufficient time to evaluate this bifurcation concept. During design studies such a proposal can be examined, if warranted.

Alternative 6. CH2M-Hill Curtain. - This alternative was also discussed by the VE team as an option (see figure 8). This concept was previously mentioned, and the VE team developed a modification of this concept which will be presented in greater detail later in this report.

Alternative 7. Modify the Existing Penstock Intake Towers. - The VE team developed a plan to modify the existing penstock intake towers into a selective level intake configuration which will be discussed in greater detail subsequently. A matrix presenting these alternatives and some possible combinations of alternatives is presented on table 1.

## CONCLUSIONS

The VE team selected the following options as being the most viable from the alternatives considered:

Option 1. Reservoir Operational Management. - This option would release cooler water directly into the river through the lower river outlets. This water, of course, would not pass through the turbines and this would result in a decrease in power revenues. This decrease in power revenues has been estimated at $74,000 per day. This use of the lower level river outlets has provided a satisfactory means of discharging cooler water during this past year's critical river temperature period. This option provides no means of conserving cooler water and is entirely dependent upon the availability of cooler water in the deeper reaches of the reservoir accessible by the various river outlet works.

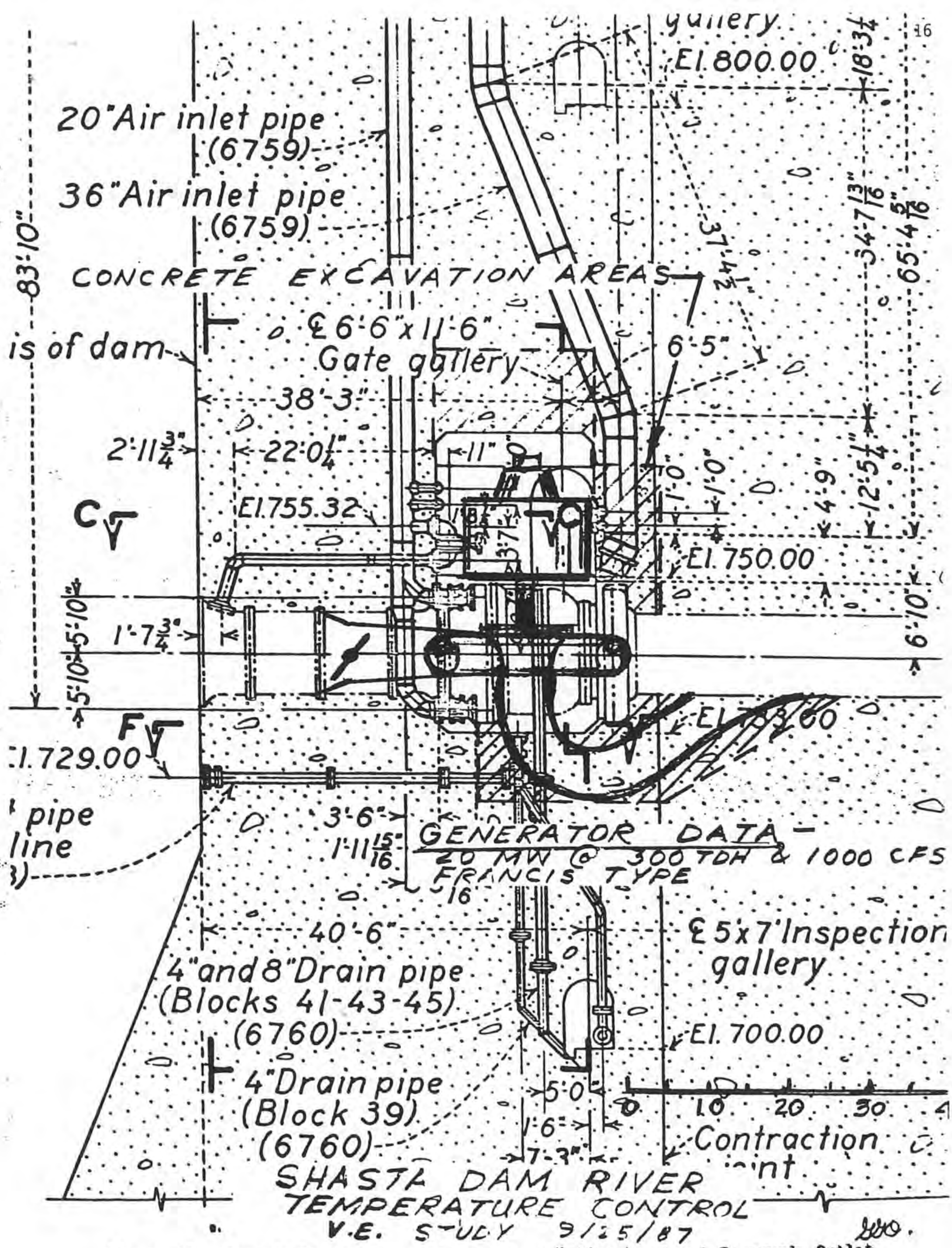



Figure 10. Francis Turbine Installation in Existing Low Level Reservoir Outlet

Table 1

Matrix of Alternative Combinations

| | Alt. 1 New Selective Level Intake | Alt. 2 Underwater Power Thruster | Alt. 3 Elephant Trunk | Alt. 4 Turbines in River Outlets | Alt. 5 Reservoir Operational Management | Alt. 6 Temperature Curtain | Alt. 7 Modify Existing Penstock Intakes |
|---|---|---|---|---|---|---|---|
| Alt. 1 New Selective Level Intake | | Mutually Contributory | Mutually Contributory | Incompatible | NA | No Connection | NA |
| Alt. 2 Underwater Power Thruster | | | Mutually Contributory | Incompatible | NA | No Connection | Mutually Contributory |
| Alt. 3 Elephant Trunk | | | | Incompatible | NA | No Connection | Mutually Contributory |
| Alt. 4 Turbines in River Outlets | | | | | NA | No Connection | No Connection |
| Alt. 5 Reservoir Operational Management | | | | | | NA | NA |
| Alt. 6 Temperature Curtain | | | | | | | No Connection |

Option 2. Installation of Turbine(s) in River Outlet(s). - The installation of an appropriate type of turbine in the lower level intake(s) would satisfactorily release cooler water while recovering the power revenue which would be lost under option 1, above. Approximately 20 MW could be generated at each outlet. The existing tube valves and some concrete would have to be removed to provide space for these units which could be used for generation during spill conditions. The installation of turbine(s) (figure 10) could significantly reduce the existing capacity of the river outlets. Such a reduction in capacity would have to be considered relative to emergency evacuation criteria as noted in ACER (Assistant Commissioner - Engineering and Research) TM (Technical Memorandum) No. 43. As mentioned previously, a technical discussion of this alternative by an E&R Center turbine designer is attached as Appendix 2.

Option 3. A Curtain-Type Temperature Modification Facility. - The VE team developed a screen-type structure based upon the CH2M-Hill concept, to allow the skimming of water from the upper reservoir during the early part of the season and then through adjustments to the screen to allow low level water withdrawal in the latter part of the summer. This concept is shown on figures 11 through 15. The curtain would be permanently installed with considerable operational flexibility.

The curtain is suspended between two curtain booms. The lower curtain boom is on the lake bottom and is heavy enough to keep the entire curtain submerged, but can be raised by partial floatation to allow cold water to pass beneath it when required for temperature modification of the river releases. During design studies it may be found to be advantageous to make the lower boom a series of weights rather than a variable bouyancy boom. The top curtain boom is suspended through partial floatation under the surface water until the top 90 to 115 feet of reservoir storage is skimmed to conserve cold water, and then the upper boom is raised to the water surface. These curtain booms are supported by underwater cables and anchors containing air chambers by which the anchors can be brought to the lake surface by adding compressed air. Most of the curtain can be installed, raised, and maintained on the reservoir surface. The remaining portions of the head tower which were used for the construction of the dam will be used for two of the anchor points.

Design considerations are:

a. Safety factors need to be generous as great damage to the intake sturctures and turbines would result if the curtain were to float into these structures. Reliability should be given top priority and serious consideration when selecting and designing this feature.

b. All connections must account for great wear and alternating stresses to prevent loosening, wearing, and fatigue failures.

c. Air tanks for lower boom should be able to withstand 200 $lb/in^2$ internal pressures. Chambers can be designed with simple port-type vents to avoid complex air release valves.

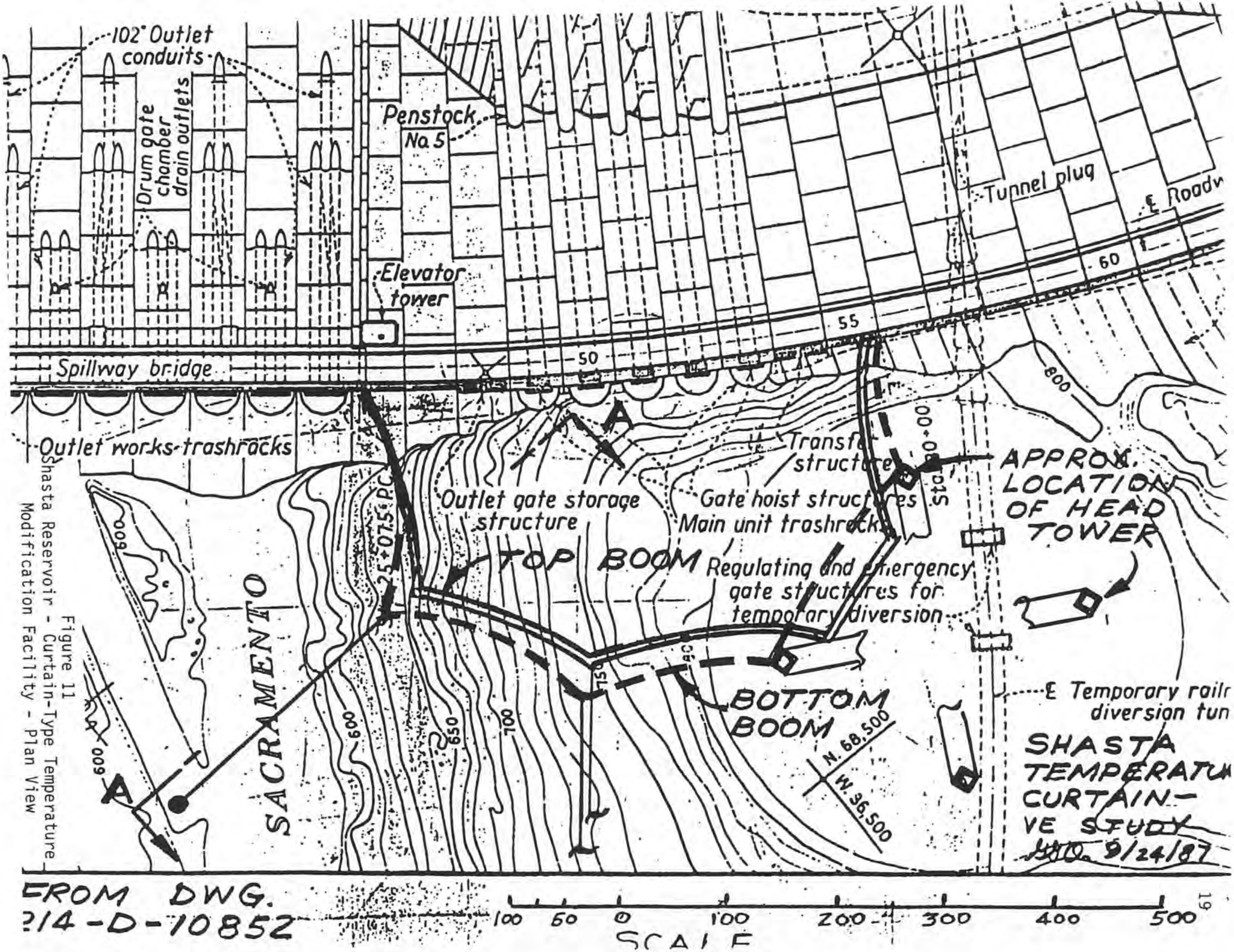



Figure 11
Shasta Reservoir - Curtain-Type Temperature Modification Facility - Plan View

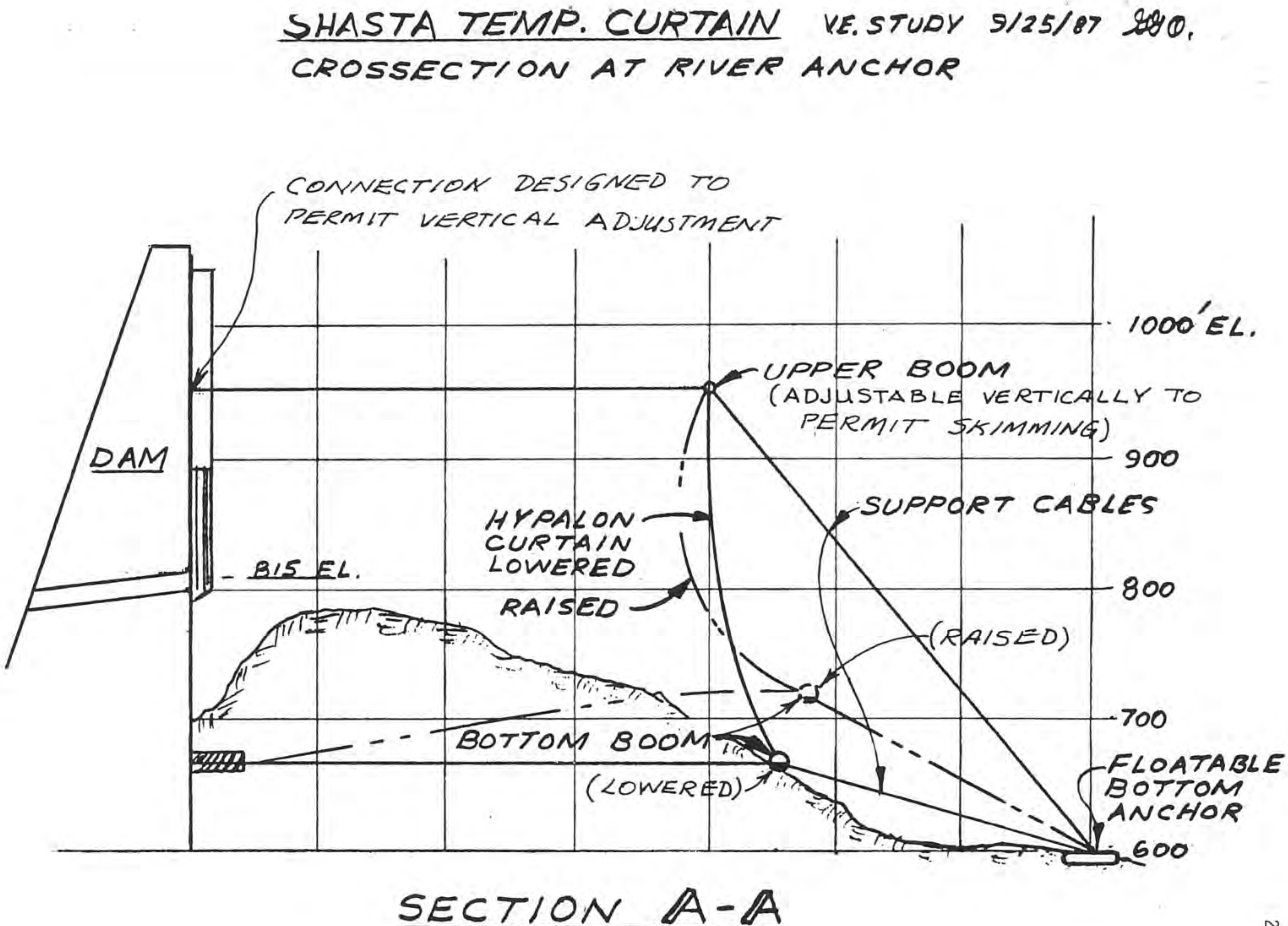
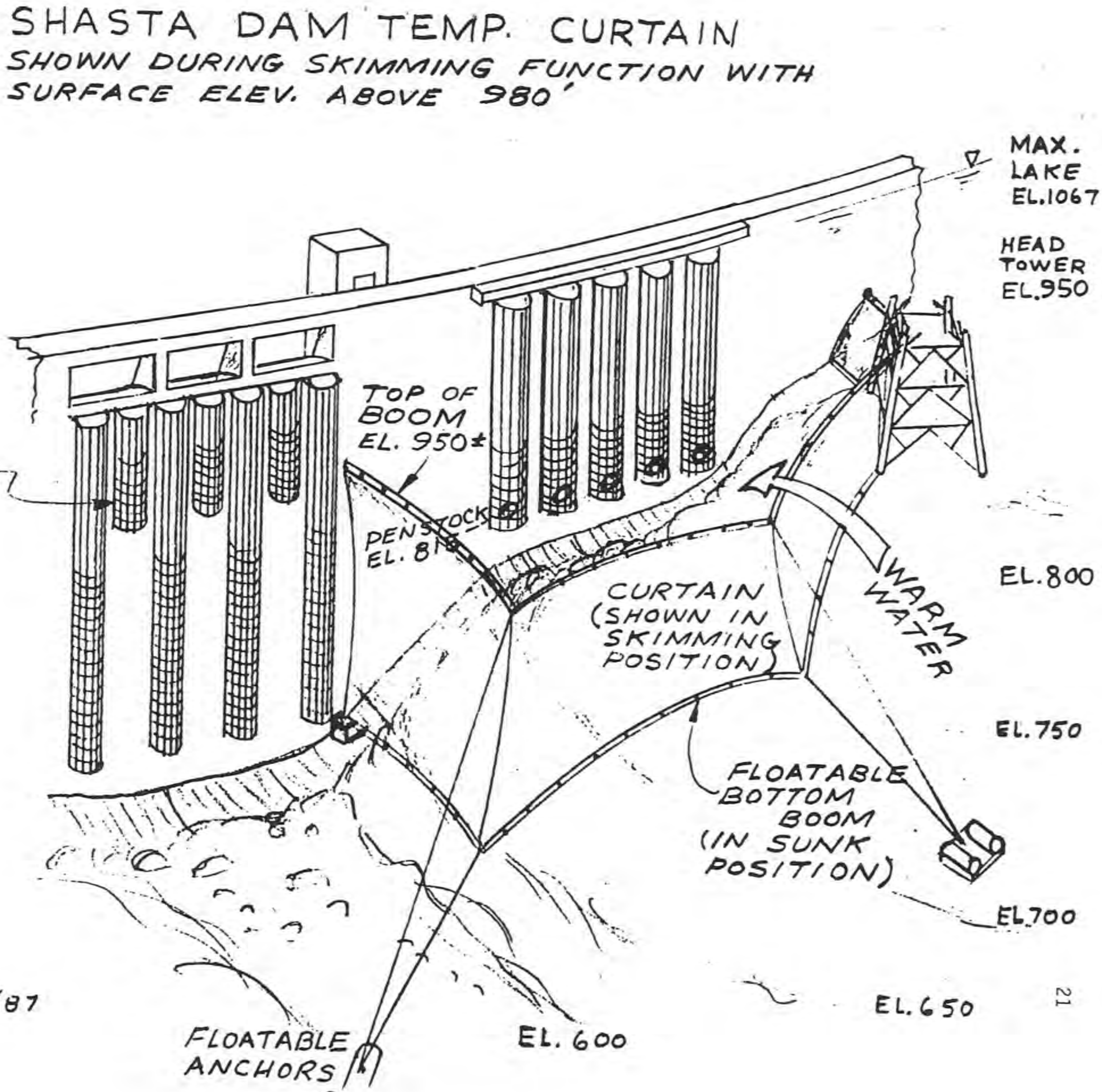



Figure 12
Shasta Reservoir - Curtain-Type Temperature Modification
Section A-A

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Greg O'Haver

Figure 13
Shasta Reservoir - Curtain-Type Temperature Modification Facility
Perspective view shown during early season skimming operations

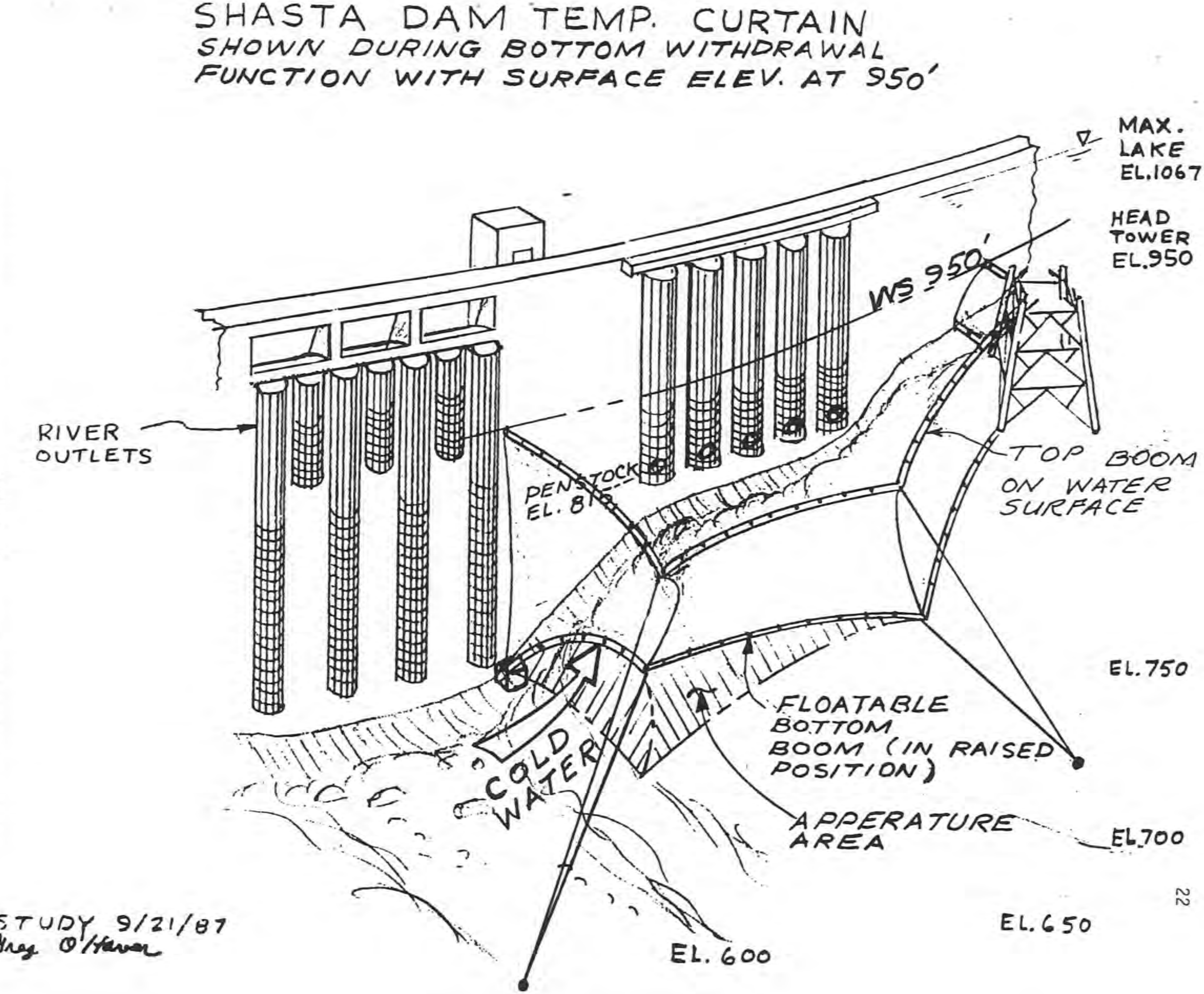


Figure 14
Shasta Reservoir - Curtain-Type Temperature Modification Facility
Perspective view shown during late season bottom withdrawal operations

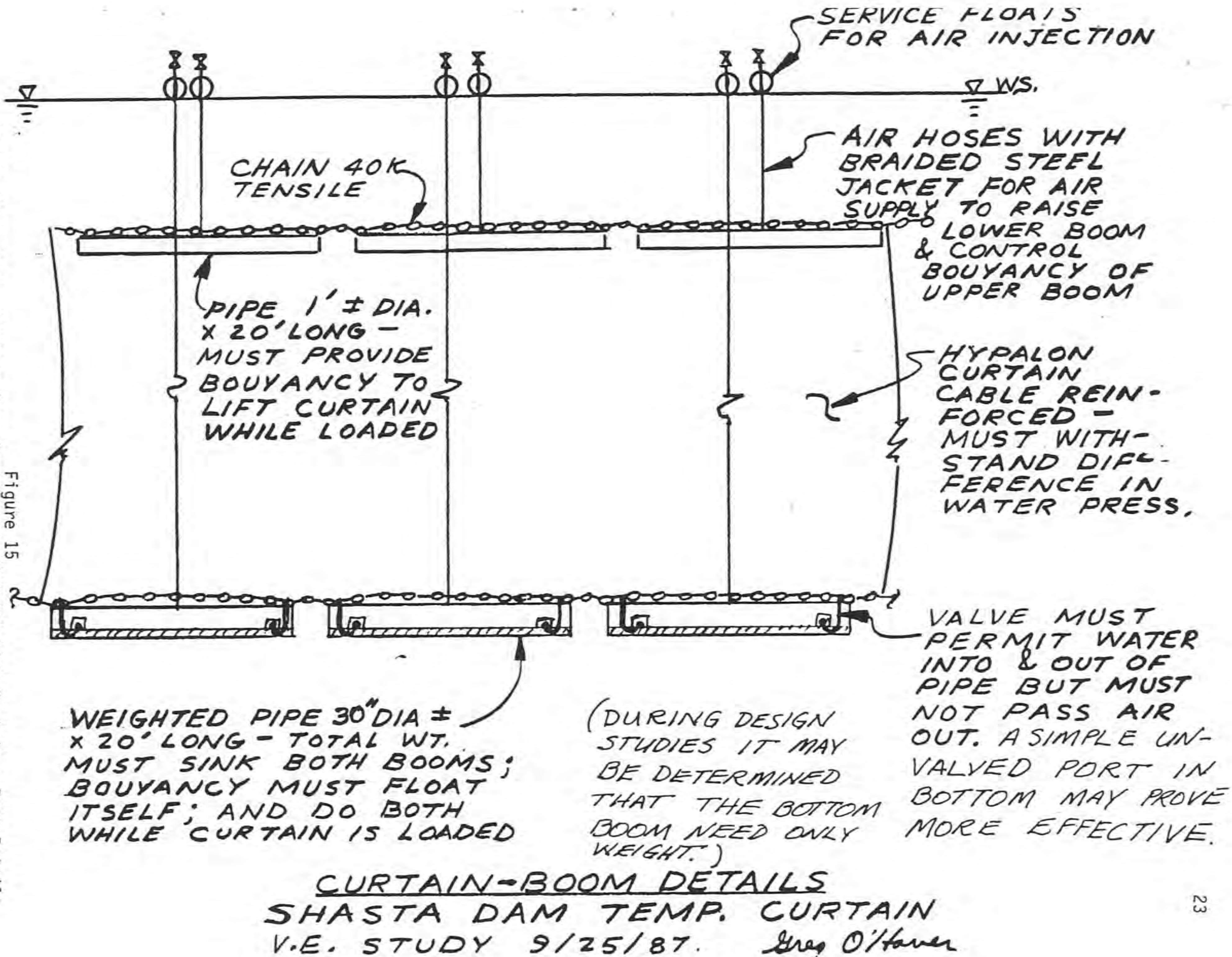


Figure 15

Shasta Reservoir - Curtain-Type Temperature Modification Curtain - Boom Details

d. Redundancy in air hoses and critical attachments to cables and chains is recommended.

e. Vandalism and recreational interference is likely and must be considered.

f. Periodic maintenance and inspections, although planned, will often be neglected or omitted.

g. Potential dynamic loading on the curtain due to underflow when the curtain is used for cold water withdrawal.

h. Uncertainty about the discharge characteristics (underflow withdrawal) of the raised curtain.

i. Uncertainty about how the curtain would be used under all reservoir conditions. In particular, it is likely that operation would shift to underflow before the water surface reaches the top of the curtain. How would the curtain perform under this condition and would density blockage occur, or would warm water be drawn into the intake?

j. A hydraulic model study likely would be required to resolve points g, h, and i. Such a model study would cost approximately $60,000 and take 6 months to complete.

The curtain-type structure should be designed with enough flexibility to withdraw water of any desired temperature or turbidity in the reservoir water column regardless of the reservoir surface water elevation. To do this, the upper anchor points on the tower and dam must be vertically adjustable (figure 12). This would allow flexibility in skiming the surface layers of the reservoir as the water surface elevation drops (figure 13). The curtain should also allow water withdrawal from midreservoir levels in cases where a midrange temperature is desired or from beneath the curtain when colder water is required (figure 14). Without this ability, water colder than required may be released causing an early depletion of the cold water in the reservoir. Midrange temperatures can be withdrawn by increasing the bottom aperture area, lowering the top of the curtain, or blending top and bottom water by simultaneously skimming from the surface and releasing from the bottom of the reservoir. The matter of fabrication, installation, operation, storage, and repair to the screen should be given serious thought if this alternative should be selected. Preliminary mathematical modeling of this option has been done since the VE study to determine an indication of its effectiveness. These models are attached as Appendix 3.

Option 4. Modify Existing Tower. - The modffication of the existing penstock intake tower(s) by the installation of additional intake openings would permit its use as an effective selective level intake. These openings should be structurally evaluated. The use of these openings would entail some head losses which would subsequently reduce power revenues. Preliminary evaluation indicates power losses would be less than 0.5 percent when upper level withdrawals were being made (estimated to be 180 days per year every other year). To avoid these losses installation of a smooth liner may be justified. The costs of this liner were not included in the VE team estimates, as the requirement for this refinement must be studied further. The use of this facility early in the season would conserve cold water supplies for use later in the season, and would retain the more turbid water for longer periods to allow additional settling. It may be necessary at times to withdraw water from below the existing intakes. This could be accomplished during those times by either:

1. Bypassing the powerplant (frequency would be reduced from the present through conservation of cold water).

2. Using an elephant trunk (alternative 3) or underwater thruster (alternative 2).

3. Installing a temporary curtain (modification of CH2M-Hill concept).

A comparison of the annual costs for these four options is presented in table 2. The economic evaluative criteria used was 50-year life, with an interest rate of 8.875 percentage. Cost estimates for options 1 through 4 are presented in Appendix 4.

The power generated during spills and temperature-controlled releases by turbines installed in the river outlet works will not offset the initial investment and repayment costs. This is primarily due to the amount of head that would be directed through the lower outlet works and the type of turbine required for the given dam layout.

The curtain will require involved installation, operations and maintenance procedures. Ascribing a cost to these is difficult because the water surface elevation when the work will be done is unknown. Underwater work is four times as costly as that on the surface. In addition, a curtain of this magnitude has never been constructed or maintained. Life cycle cost estimates reflect this lack of experience.

The determination of accomplishment (turbidity and temperature control) from the various alternatives is beyond the scope of this study. To ascertain the degree of success to anticipate from each concept, further math or physical model studies will be required to determine the optimum design and accomplishment of a certain device for downstream temperature and turbidity control.

Mathematical Model Studies. - Mr. Jack Rowell, Mid Pacific Region, was asked by the VE team to run some trial mathematical model studies of some VE team concepts. The purpose of the studies was to determine if these concepts were capable of achieving the required temperature objectives. These studies are shown as Appendix 3.

Table 2

Shasta Dam Temperature Modification Value Engineering Study
Annual Cost Comparison

| | Option 1 Reservoir Operational Management | Option 2 Turbines in River Outlets | Option 3 Curtain-Type Temperature Modification Facility | Option 4 Modify Existing Tower |
|---|---|---|---|---|
| Construction Cost | N/A | $35,847,000 | $4,542,000 | $7,828,000 |
| Annual Capital Cost | N/A | $ 3,227,000 | $ 410,000 | $ 705,000 |
| Annual O&M Costs | N/A | $ 160,000 | $ 7,000 | $ 3,000 |
| Annual Replacement Costs | N/A | $ 3,000 | $ 259,000 | $ 2,000 |
| Annual Power Revenue | N/A | $ 840,000 | 0 | 0 |
| Annual Power Costs | $1,017,000 | 0 | 0 | $ 96,000 1/ |
| Estimated Annualized Costs | $1,017,000 | $ 2,550,000 | $ 676,000 | $ 806,000 |

1/ Can be reduced by installation of appropriate lining in towers to reduce head losses during skimming operations.

During the VE team presentation several topics came under discussion, these are listed below in order that they may receive consideration:

1. Should the turbine option be adopted, the turbines should be designed and constructed so that they may be "blown" away during an emergency.

2. Bubbles instead of fans could be used to lift colder water in the elephant trunk or thruster alternatives.

3. The design team should work out design details, etc., as a team effort not as individuals. It was recommended that heavy use of consultants experienced in the particular design adopted be used.

Cost estimates for options 1 through 4 are attached as Appendix 4.

Comments From Draft Review

The VE team would like to express their thanks to those Reclamation employees both from Mid Pacific Region and the E&R Center, who reviewed and commented on the draft of this report. Their efforts have provided a wider perspective of the study than would have been available from the VE team alone. Many of the review comments were incorporated into this draft of the report. Those comments which could not be incorporated into the context of the report have been included as Appendix 5.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
CENTRAL VALLEY REGION
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21 September 1987

Mr. David Houston
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2800 Cottage Way
Sacramento, CA 95825

TENTATIVE WASTE DISCHARGE REQUIREMENTS FOR SHASTA UNIT

Enclosed is a copy of draft tentative waste discharge requirements for the discharge of stored water from Keswick and Shasta Dams and the Spring Creek Power Plant. Any comments or recommendations you may have concerning this order should be submitted to our Redding office at 100 E. Cypress Avenue, Redding, CA 96001, in writing, by 5 October 1987, in order that consideration may be given them prior to the meeting of the Regional Board in October.

I still feel it would be beneficial to meet with you and your staff to discuss these requirements prior to their distribution for review by interested agencies. Please contact me at 361-5640 so we can arrange a meeting at the earliest possible date.

These requirements are submitted for your review as indicated in our 9 September letter. We are still intending to submit these requirements to the Board for consideration of adoption at their 23 October 1987 meeting. The location of this meeting has been changed from Redding to the City Council Chambers, 555 Washington Street, Red Bluff.

William H. Crooks

WILLIAM H. CROOKS
Executive Officer

NOTICE: IF YOU DETACH ENCLOSURE PLEASE INSERT
CODE NO. ______
INITIAL ______
DATE ______

Enclosure

cc: Regional Board Members
Mr. James L. Easton, Executive Director, State Water Resources Control Board, Sacramento

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. ______

WASTE DISCHARGE REQUIREMENTS
FOR
U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION
SHASTA UNIT
SHASTA COUNTY

TENTATIVE

The California Regional Water Quality Control Board, Central Valley Region (hereafter Board) finds that:

1. The U.S. Department of Interior, Bureau of Reclamation (hereafter Discharger) was requested, on 17 June 1987, to file a Report of Waste Discharge for selected discharges from the Shasta Unit of the Central Valley Project.

2. The Discharger failed to submit a Report of Waste Discharge.

3. The Board, on 26 March 1971, issued Waste Discharge Requirements Order No. 71-228 to the Bureau for the discharge of oil, grease, and domestic wastes from the Shasta Dam and Power Plant. Order No. 71-228 does not regulate similar discharges from other Shasta Unit facilities or the discharge of release water containing the pollutants, temperature, and turbidity from unit reservoirs.

4. The discharge of oil, grease, domestic wastes and toxic substances from point and non-point sources as a result of power plant operations at all Shasta Unit facilities in the Sacramento River drainage will be covered under separate NPDES permits for each facility.

5. The Discharger discharges an average of about 7,000 cubic feet per second (cfs), 15,000 cfs, and 12,000 cfs of stored Shasta Lake water, during fall, winter, and summer months, respectively, to the Sacramento River via Keswick Reservoir (a regulating forebay which receives flows from Shasta Dam, Spring Creek Debris Dam, and the Spring Creek Power Plant which imports water from the Trinity River System.

6 Shasta Dam is located in Section 15, T33N, R5W, MDB&M approximately 10 miles north of Redding. Keswick Dam and Spring Creek Power Plant are located in Sections 17 and 18, respectively, T32N, R5W, MDB&M, about 7 miles south of Shasta Dam.

7. Shasta Dam impounds Shasta Lake which contains 4.5 million acre feet at full storage and is fed by the Sacramento, Pit, and McCloud Rivers.

8. As a result of storage, changes in water temperature and turbidity occur in Shasta Lake which affect downstream waters. When beneficial uses can be affected, discharge of water having elevated temperature and turbidity constitutes a waste subject to regulation under the California Water Code.

9. Such wastes could be controlled to a degree by modification of Shasta Dam to allow for selection of the most appropriate depth of water for discharge. Water temperature downstream from Keswick Dam can also be controlled to a degree by the volume and timing of Spring Creek Power Plant discharges.

10. The Board, on 25 July 1975, adopted a Water Quality Control Plan (Basin Plan) for the Sacramento River Basin (5A) which contains water quality objectives for all waters of the Basin. These requirements are consistent with that Plan.

11. The beneficial uses of the Sacramento River are municipal, industrial, and agricultural supply; recreation; esthetic enjoyment; hydroelectric power generation; navigation; ground water recharge; fresh water replenishment; and preservation and enhancement of fish, wildlife, and other aquatic resources.

12. Discharges from Shasta and Keswick Dams, have periodically exceeded the Board's Basin Plan water quality objective for temperature ($\leq$56 degrees Fahrenheit (°F.) from Keswick Dam to Hamilton City). Also, in years of substantial inflow, and severe storms, Shasta Dam has discharged turbid water from the early spring into the early fall months, whereas inflow streams were generally clear during that period.

13. Water temperature exceeding 56°F. causes mortality of salmon eggs and fry. Water temperatures exceeded 56°F. in spawning areas of the upper Sacramento River during the late summer and early fall months of several years during the period 1970-1984. Winter run chinook salmon spawning/incubation occurs from April through September. Fall run chinook salmon spawning/incubation occurs from October through March.

14. Recent modeling studies (Central Valley Fish and Wildlife Management Study) by the Discharger predict that water temperature of Shasta Dam discharges will increase under planned operations during the next three decades. Those studies indicate that water temperature in salmon spawning areas of the upper Sacramento River will typically exceed 56°F. during the late summer/early fall months unless temperature control actions are taken.

TENTATIVE

15. The beneficial use of the upper Sacramento River for cold freshwater habitat and fish spawning is not being adequately protected as evidenced by depressed fish stocks (specifically winter and fall run chinook salmon). Provision of adequate habitat is a major factor to the improvement of fish propagation as indicated in state policy and recent state legislation (SB1086).

16. The action to adopt waste discharge requirements for this existing facility is exempt from the provisions of the California Environmental Quality Act, in accordance with Section 15301, Title 14, California Administrative Code.

17. The Board has notified the Discharger and interested persons and agencies of its intent to prescribe waste discharge requirements for this discharge, and has provided them with an opportunity for a public hearing and an opportunity to submit their written views and recommendations.

18. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

**IT IS HEREBY ORDERED** that the U.S. Department of Interior, Bureau of Reclamation, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. **Receiving Water Limitations** (Discharge from Shasta Dam and Spring Creek Power Plant via Keswick Dam):

   1. The discharge shall not cause the average daily water temperature of the Sacramento River in the reach between Keswick Dam and the Red Bluff Diversion Dam to exceed 56°F.

   2. The discharge shall not increase the turbidity of Keswick Reservoir or the downstream Sacramento River by more than the following:

      a. 20 percent when the mean turbidity of the Sacramento, Pit, and McCloud Rivers upstream of Shasta Lake is between 0 and 50 NTU.

      b. 10 NTU when the mean turbidity of the Sacramento, Pit, and McCloud Rivers upstream of Shasta Lake is between 50 and 100 NTU.

      c. 10 percent when the mean turbidity of the Sacramento, Pit, and McCloud Rivers upstream of Shasta Lake is greater than 100 NTU.

   3. The discharge shall not depress the dissolved oxygen level in Keswick Reservoir below 9.0 mg/l at any time.

TENTATIVE

B. **Provisions:**

1. The Discharger may be required to submit technical reports as directed by the Executive Officer.

2. The Discharger shall comply with the attached Monitoring and Reporting Program No. _______.

3. The Discharger shall comply with the Standard Provisions and Reporting Requirements, dated 1 September 1985, which are a part of this Order.

4. The Discharger shall comply with the following time schedule to assure compliance with receiving water limitation A.1. and A.2. above:

| Task | Date of Compliance | Report of Compliance Due |
|---|---|---|
| Complete Detailed Design | 1 October 1988 | 15 October 1988 |
| Begin Construction | 1 April 1988 | 15 April 1988 |
| Complete Construction | 1 June 1989 | 15 June 1989 |
| Full Compliance | 1 July 1989 | 15 July 1989 |

The Discharger shall submit to the Board on or before each compliance report date, a report detailing its compliance or noncompliance with the specific schedule date and task.

If noncompliance is being reported, the reasons for such noncompliance shall be stated, plus an estimate of the date when the discharge will be in compliance. The Discharge shall notify the Board by letter when he has returned with the time schedule.

5. During periods or conditions when the Discharger can demonstrate that compliance with Receiving Water Limitation A.2. (turbidity) will result in violation of Receiving Water Limitation A.1. (temperature), Limitation A.2. is not applicable.

6. The Discharger shall report promptly to the Board any material change or proposed change in the character, location, or volume of the discharge.

7. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to this office.

8. The Board will review this Order periodically and may revise requirements when necessary.

**I, WILLIAM H. CROOKS,** Executive Officer, do hereby certify that the foregoing is a full, true, and correct, copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region on ____________________.

____________________________________
WILLIAM H. CROOKS, Executive Officer

RHL:jdg:sg 9/21/87

Attachments

TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. _______
FOR
U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION
SHASTA UNIT
SHASTA COUNTY

TENTATIVE

## RECEIVING WATER MONITORING

Receiving water samples shall be collected from stations or points listed below according to the following:

| Station/Point | Description |
|---|---|
| R-1 | Shasta Dam inlets or lake adjacent to dam face with sufficient collection points to characterize the vertical profile for temperature and turbidity. |
| R-2 | Shasta Dam discharge immediately downstream from switchyard, east bank. |
| R-3 | Existing Department of Water Resources Station downstream from Keswick Dam. |
| R-4 | Spring Creek Power Plant tailrace. |
| R-5 | Existing Department of Water Resources station downstream from Red Bluff Diversion Dam. |
| R-6 | Sacramento River - Dog Creek Bridge |
| R-7 | McCloud River - Gilman Road Bridge |
| R-8 | Pit River - Pacific Gas and Electric Pit 7 Powerhouse |

The following shall constitute the receiving water monitoring:

| Constituents | Units | Station | Sampling Frequency | Type of Sample |
|---|---|---|---|---|
| Temperature | °F. | R-1 | Bi-monthy from 1 may through 30 November | Optional |
| | | R-2 | Continuous | -------- |
| | | R-3 | " | |
| | | R-4 | " | |
| | | R-5 | " | |
| Turbidity | Turbidity Units | R-1<br>R-2<br>R-3<br>R-4<br>R-6<br>R-7<br>R-8 | Weekly from 1 May through 30 September when turbidity at Station R-2 is equal to or greater than 10 NTU | Optional |
| Flow | cfs (Average Daily) | R-2<br>R 3<br>R-4 | ----------- | -------- |

## REPORTING

In reporting monitoring data, the Discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner to illustrate clearly the compliance with waste discharge requirements.

Monthly monitoring reports shall be submitted to the Regional Board by the 15th day of the following month.

The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall be reported to he Board.

TENTATIVE

The Discharger shall submit an annual report to the Board by 15 March 1988 and 30 January or each subsequent year. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the Discharge shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

The Discharger shall implement the above monitoring program on the effective date of this Order.

Ordered by ________________________________
WILLIAM H. CROOKS, Executive Officer

________________________________
(Date)

RHL:jdg:sg 9/21/87

TENTATIVE


SHASTA UNIT FACILITIES
U.S. BUREAU OF RECLAMATION
Shasta County

Section 15, T33N, R5W, MDB&M
Sections 17&18, T32N, R5W, MDB&M
USFS Shasta National Forest Map
Scale: 1 inch = 2 miles

D-251 Drake's Comments On
Shasta Dam Temperature Modification
Value Engineering Study
September 1987

The following comments concern the alternative proposed to install a turbine(s) on the river outlet works:

1. **Concern:** How will the water be stopped upstream of the existing valve to allow the valve to be removed and a new valve and turbine to be installed?

1. **Suggestion:** Install the turbine downstream of the existing valve, use the existing valve for a shut off valve and excavate concrete to install the turbine and generator.

2. **Concern:** The elevation of the turbine would be well above tailwater which would not allow any submergence therefore the unit would operate poorly.

2. **Suggestion:** Design a method to throttle the outlet of the draft tube-outlet pipe to place "back pressure" on the turbine.

3. **Concern:** How will the turbine and generator parts be brought into place and then handled for installation and in the future for maintenance?

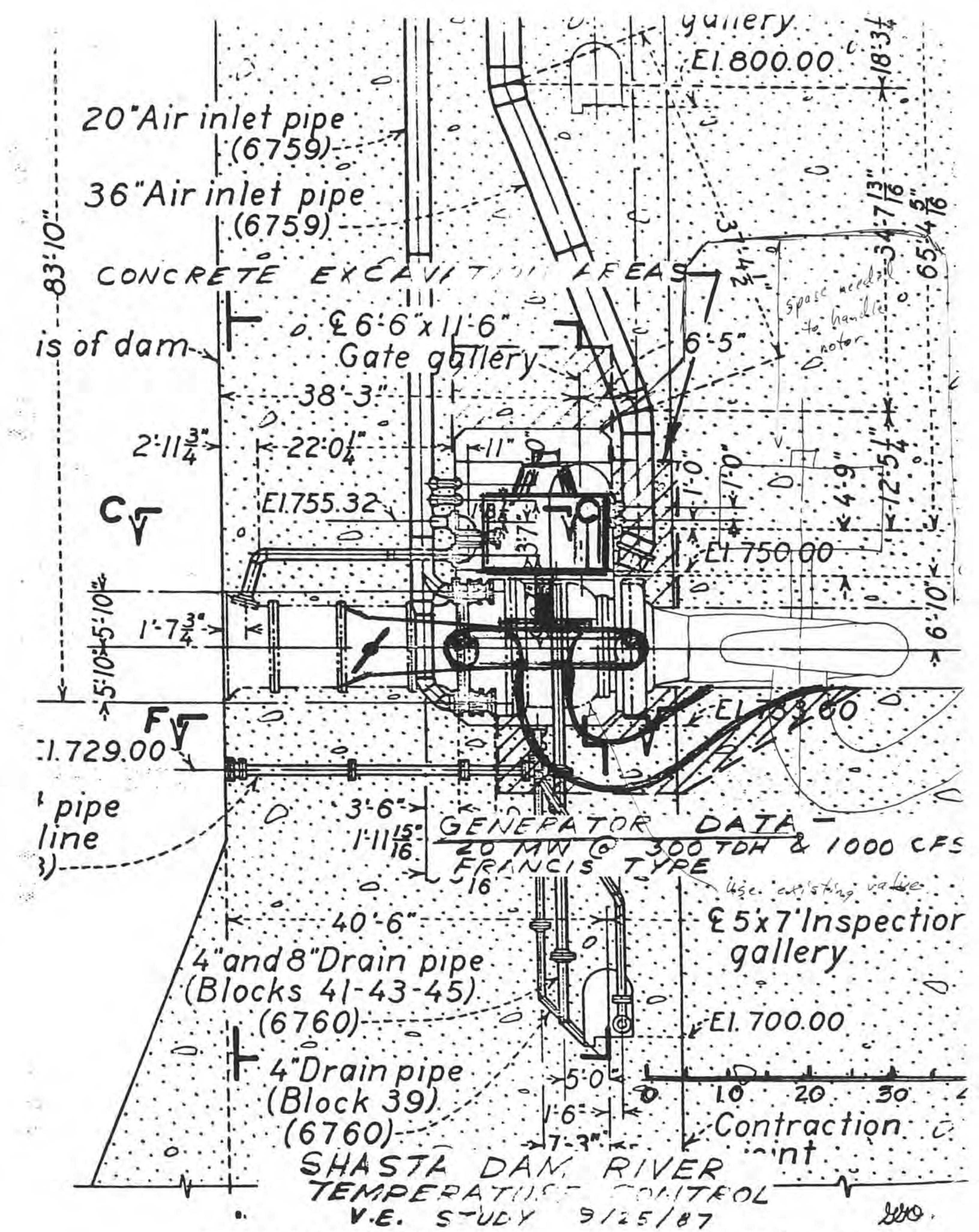
3. **Suggestion:** It may be appropriate to install a crane in the chamber above the unit. Getting the parts into the chamber will still be difficult.

4. **Concern:** The sketch in the report shows insufficient space above the generator to allow the installation or removal of the generator rotor.

4. **Suggestion:** See the marked sketch for additional space needed.

5. **Concern:** If each outlet pipe now passes 4000 CFS (16000 CFS total) and each turbine would pass 1000 CFS (4000 CFS total), how does this affect the reservoir evacuation criteria etc.?

5. **Suggestion:** Install one turbine on one outlet pipe capable of passing 4000 CFS and don't modify the other outlets. The turbine would be about twice as big on all dimensions as the 1000 CFS unit.



gallery
El. 800.00
18'-3 1/4"
20" Air inlet pipe (6759)
36" Air inlet pipe (6759)
83'-10"
CONCRETE EXCAVATION AREAS
34'-7 13/16"
65'-4 5/16"
3'-4 1/2"
space needed to handle motor
℄ 6'-6" x 11'-6" Gate gallery
is of dam
6'-5"
38'-3"
2'-11 3/4"
22'-0 1/4"
11"
1'-0"
1'-0"
4'-9"
12'-5 1/4"
El. 755.32
C
3'-7
El. 750.00
5'-10"
5'-10"
1'-7 3/4"
6'-10"
F
El. 729.00
pipe
line
3'-6"
1'-11 15/16"
GENERATOR DATA
20 MW @ 300 TDH & 1000 CFS
FRANCIS TYPE
use existing valve
40'-6"
℄ 5'x7' Inspection gallery
4" and 8" Drain pipe (Blocks 41-43-45) (6760)
El. 700.00
4" Drain pipe (Block 39) (6760)
5'-0"
1'-6"
7'-3"
0
10
20
30
Contraction joint
SHASTA DAM RIVER TEMPERATURE CONTROL
V.E. STUDY 9/25/87

Memorandum
To: Gary W. Long

From: Jack Rowell

Subject: Shasta Temperature Control Structure - Temperature Model Studies

As requested, enclosed are some temperature model studies evaluating various Shasta temperature control options. Exhibits 1 and 2 are for 1987 and 1976, respectively. Both were dry years, but 1976 was much drier.

Options

Curtain: assumes withdrawal capability from following levels:

650 ft., 750 ft., 900 ft., 925 ft., 950 ft., 975 ft., 1,000 ft., 1,025 ft.

Skim: 815 ft., 900 ft., 925 ft., 950 ft., 975 ft., 1,000 ft., 1,025 ft.

Bypass: 750 ft., 815 ft., 900 ft., 925 ft., 950 ft., 975 ft., 1,000 ft., 1,025 ft.

Power: 815 ft., (existing level)

Temperature Criteria

Shasta releases were made to best meet 56°F at Red Bluff all year.

Reservoir Printout Symbols:

STOR: EOM storage

TA: Air temperature: Shasta Dam average (1944-70)

TMPIN: Inflow temperature: flow-weighted average of Pit, McCloud, and Sacramento River inflows (1964-77).

TMPMX, TMPMN: Target Shasta release temperatures to meet 56° F at Red Bluff.

TPOUT: Shasta release temperature: flow-weighted average of outlet releases.

TKESW: Keswick Lake temperature above confluence of Spring Creek. Calculated from equilibrium temperature equation using long-term climate data, end Shasta outflow and TPOUT.

QOUTL: Release ($ft^3$) from each outlet level.

TOUTL: Temperature of release from each outlet level.

River Printout Symbols (following reservoir printout):

- MO : Month
- AB.S.C.: Temperature above Spring Creek (same as TKESW).
- S.C. : Temperature of Spring Creek Powerplant release. Calculated values for 1987 were also used for 1976.
- KES : Release temperature from Keswick Dam. Mass balance calculation using temperatures AB.S.C. and S.C. and historical flows from Shasta Dam and Spring Creek Powerplant, respectively.
- C.C. : Calculated temperature at Cottonwood Creek (about midway between Keswick and Red Bluff).
- R.B. : Calculated temperature at Red Bluff. River temperature model neglects affects of tributary accretions, which are usually significant only during winter and spring months.

## Conclusions

In 1987, the curtain and bypass options resulted in identical Red Bluff temperatures, meeting the criteria in all months. The skim option exceeded the criteria slightly in September. The power (existing) option substantially exceeded the criteria in August through October.

In 1976, the curtain option exceeded the criteria only in September, the bypass option in August and September, the skim option in August and September with much higher August temperatures than bypass, and the power option in July through September. October temperatures were met in 1976 because Shasta releases were cut back with most of Keswick release coming from the Spring Creek power plant (Trinity Diversion).

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                  SHASTA LAKE TEMPERATURE PREDICTIONS
                  TEMPERATURE CONTROL STUDY: CURTAIN-650-1025 ~~LEFT JUL 88~~
                  AUGUST 14, 1987 FORECAST: JAN 87 - JUL 88
OTHE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

   NYR     IYR    NPER    IPER   MSTRT   NLAYR   LAYER   NOUTL   NMINO   IDEPV   METHC   IDGET    NIL     NIT    NOUTL   INTER
     1 :  1987      12       1       1      97       5       8       0       0       0       0      1       0       0      10
  MREL     NMO
     0       3

  STORA      CISA      COSA    STRMX    STRMN      TIN     TAIR     EVAP     PREP     OMIN     THAX     TMIN    CSOUT     SOLR     DEP
2973200.-1000.000-1000.0004950000.       0.       -1.      -1.     -2.00    -2.00     -2.      -1.      -1.     .504      -1.   32.91
0      AIR TEMP COEF    INFLO MIXING COEF        DIFFUSION COEF        EVAP HEAT COEF       INSOLATION COEF
         1.000                .048                    .013                  .655                 .155

 TCAP=      495.      806.     1234.     1801.     2531.     3442.     4578.     5931.     7518.     9341.
          11404.    13721.    16318.    19234.    22507.    26171.    30251.    34766.    39735.    45173.
          51102.    57541.    64522.    72089.    80306.    89247.    99967.   109582.   121069.   133466.
         146785.   161066.   176346.   192698.   210145.   228752.   249514.   269414.   291443.   314621.
         339002.   364674.   391736.   420274.   450366.   492176.   515543.   550512.   587127.   625450.
         665511.   707355.   751027.   796358.   843589.   892763.   943929.   996795.  1051213.  1108729.
        1167898.  1228773.  1291854.  1357174.  1424780.  1494336.  1566238.  1640529.  1717255.  1795993.
        1876996.  1960627.  2046829.  2135150.  2226093.  2319700.  2416019.  2514929.  2616632.  2721146.
        2820544.  2938672.  3051750.  3167820.  3286929.  3408655.  3533479.  3661442.  3792590.  3926232.
        4063108.  4203254.  4346717.  4492742.  4642179.  4794860.  4950723.

 TSTRT=     45.0      45.0      45.0      45.0      45.0      45.1      45.1      45.1      45.1      45.1
            45.2      45.2      45.2      45.3      45.3      45.3      45.4      45.4      45.4      45.5
            45.5      45.5      45.5      45.6      45.6      45.6      45.7      45.7      45.7      45.8
            45.8      46.0      46.2      46.4      46.6      46.7      46.8      46.9      47.0      47.0
            47.0      47.2      47.5      47.8      48.1      48.4      48.6      48.7      48.8      48.9
            48.9      49.0      49.1      49.2      49.3      49.4      49.5      49.6      49.7      49.9
            50.1      50.1      50.2      50.3      50.3      50.4      50.4      50.5      50.5      50.6
            50.6      50.6      50.7      50.7      50.8      50.8      50.8      50.9      50.9      51.0
            51.0      51.0      51.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0
            -1.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0

 STOUT=   11404.   146785.  1167888.  1494336.  1876996.  2319700.  2928544.  3409455.

                                              RESERVOIR TEMPERATURES
 YEAR  PER     1     2     3     4     5     6     7     8     9    10    11    12    13    14    15    16    17    18    19    20
 1987    1  45.0  45.0  45.0  45.0  45.0  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2
            45.2  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.6  45.6  45.6  45.7  45.7  45.8  45.8
            45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9
            45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9
            45.9  45.9  45.9
```

Exhibit 1

1.009 .048 .013 .455 .155

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STCAP= | 495. | 806. | 1234. | 1801. | 2531. | 3449. | 4579. | 5931. | 7518. | 9341. |
| | 11404 | 13721 | 16318. | 19234. | 22507. | 26171. | 30251. | 34766. | 39735. | 45173. |
| | 51102. | 57541. | 64522. | 72089. | 80306. | 89247. | 99967. | 109582. | 121029. | 133466. |
| | 146785. | 161066. | 176346. | 192688. | 210146. | 228752. | 249514. | 269414. | 291443. | 314621. |
| | 339002. | 364674. | 391736. | 420274. | 450366. | 492176. | 515544. | 550512. | 587127. | 625450. |
| | 665511. | 707355. | 751027. | 796358. | 843589. | 892753. | 943929. | [illegible] | 1051113. | 1108729. |
| | 1167888. | 1228773. | 1291854. | 1357174. | 1424780. | 1494336. | 1564239. | [illegible] | [illegible] | 1795993. |
| | 1876996. | 1960627. | 2046829. | 2135150. | 2226093. | 2319700. | 2416019. | 2514920. | [illegible] | [illegible] |
| | 2828544. | 2938672. | 3051750. | 3167820. | 3286929. | 3409555. | 3533479. | 3661142. | 3792590. | 3926333. |
| | 4063108. | 4203254. | 4346717. | 4492742. | 4642178. | 4794860. | 4950723. | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TSTRT= | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 |
| | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 |
| | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 |
| | 45.8 | 46.0 | 46.2 | 46.4 | 46.6 | 46.7 | 46.9 | 46.9 | 47.0 | 47.0 |
| | 47.0 | 47.2 | 47.5 | 47.8 | 48.1 | 48.4 | 48.6 | 48.7 | 48.9 | 48.9 |
| | 48.9 | 49.0 | 49.1 | 49.2 | 49.3 | 49.4 | 49.5 | 49.6 | 49.7 | 49.9 |
| | 50.1 | 50.1 | 50.2 | 50.3 | 50.3 | 50.4 | 50.4 | 50.5 | 50.5 | 50.6 |
| | 50.6 | 50.6 | 50.7 | 50.7 | 50.8 | 50.8 | 50.8 | 50.9 | 50.9 | 51.0 |
| | 51.0 | 51.0 | 51.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 |
| | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | | | |

STOUT= 11404. 146785. 1167888. 1494336. 1876996. 2319700. 2828544. 3409555.

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | | | | | | | | | | | | | | | | | |
| 1987 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.8 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.1 | 46.2 | 46.5 |
| | | 47.4 | 48.2 | 48.7 | 48.8 | 48.9 | 48.9 | | | | | | | | | | | | | | |
| 1987 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.6 | 47.0 |
| | | 47.5 | 47.6 | 47.7 | 47.7 | 47.9 | 48.4 | 48.7 | 50.8 | 51.3 | 51.5 | 51.5 | 51.6 | | | | | | | | |
| 1987 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 |
| | | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.3 | 46.4 | 46.6 | 46.9 | 47.2 |
| | | 47.7 | 48.6 | 49.3 | 50.3 | 52.0 | 54.2 | 56.8 | 57.8 | 59.1 | 59.3 | 59.3 | | | | | | | | | |
| 1987 | 5 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.7 | 49.0 | 49.0 | 50.5 | 52.9 |
| | | 56.0 | 59.2 | 61.5 | 63.2 | 64.2 | 64.6 | 64.7 | 64.8 | 64.8 | | | | | | | | | | | |
| 1987 | 6 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 |
| | | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.1 | 46.3 | 46.6 | 47.5 | 51.7 | 54.3 | 57.3 | 60.3 | 63.0 | 65.1 | 67.7 | 70.0 | 71.4 |
| | | 72.1 | 72.4 | 72.6 | 72.6 | | | | | | | | | | | | | | | | |
| 1987 | 7 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.8 | 45.9 | 45.9 | 46.0 |
| | | 46.2 | 47.7 | 49.5 | 52.9 | 56.8 | 60.2 | 62.8 | 65.1 | 67.4 | 69.4 | 70.7 | 72.4 | 74.9 | 77.3 | 79.6 | 79.3 | 79.6 | 79.7 | 79.8 | |
| 1987 | 8 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.8 | 45.9 | 45.8 | 45.8 | 45.9 | 45.8 | 45.8 | 45.9 | 45.8 |
| | | 45.8 | 45.9 | 45.9 | 46.0 | 46.1 | 46.2 | 46.5 | 46.8 | 47.2 | 47.7 | 49.5 | 49.7 | 51.5 | 54.0 | 56.9 | 59.6 | 62.0 | 64.2 | 66.2 | 67.9 |
| | | 69.1 | 69.7 | 70.4 | 71.4 | 72.6 | 73.9 | 75.3 | 76.6 | 77.5 | 79.0 | 79.2 | 79.3 | 79.3 | 79.3 | | | | | | |
| 1987 | 9 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 46.0 | 46.0 | 46.1 | 46.2 | 46.3 | 46.4 | 46.6 | 46.8 | 47.1 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 9 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 46.0 | 46.0 | 46.1 | 46.2 | 46.3 | 46.4 | 46.6 | 46.9 | 47.1 |
| | | 47.4 | 47.9 | 48.4 | 49.1 | 49.9 | 51.0 | 52.2 | 53.6 | 55.2 | 56.9 | 58.7 | 60.4 | 62.0 | 63.5 | 64.7 | 65.6 | 66.2 | 66.7 | 67.0 | 68.2 |
| | | 69.0 | 69.8 | 70.5 | 71.2 | 71.8 | 72.3 | 72.6 | 72.9 | 73.1 | 73.2 | 73.3 | 73.3 | 73.3 | 73.3 | | | | | | |
| 1987 | 10 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.6 | 45.7 | 45.8 | 46.0 | 47.5 | 47.8 | 48.1 | 48.5 | 49.0 | 49.5 | 50.1 | 50.8 | 51.5 |
| | | 52.4 | 53.3 | 54.3 | 55.3 | 56.4 | 57.5 | 58.5 | 59.3 | 59.7 | 60.0 | 60.4 | 60.9 | 61.5 | 62.2 | 62.8 | 63.4 | 63.8 | 64.0 | 64.0 | 64.0 |
| | | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | | | | | | |
| 1987 | 11 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 |
| | | 45.5 | 45.6 | 45.8 | 45.9 | 46.1 | 46.4 | 46.8 | 47.4 | 49.5 | 50.1 | 51.3 | 51.8 | 52.0 | 52.1 | 52.3 | 52.4 | 52.6 | 52.8 | 52.9 | 53.1 |
| | | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 |
| | | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | | | | | | |
| 1987 | 12 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.6 |
| | | 45.7 | 45.8 | 45.9 | 46.1 | 46.2 | 46.3 | 46.3 | 46.3 | 46.3 | 46.4 | 46.4 | 46.5 | 46.6 | 46.6 | 46.7 | 46.8 | 46.8 | 47.0 | 47.1 | 47.2 |
| | | 47.4 | 47.6 | 47.7 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 |
| | | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | | | | | | |

FLOWS AND TEMPERATURES FOR 1987

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 5587.9 | 5366.9 | 9037.2 | 14692.4 | 6255.0 | 4674.1 | 3421.6 | 3659.3 | 2732.3 | 2923.3 | 2252.7 | 5041.7 | 2099.8 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10851.0 | 3465.3 | 3068.9 | 4021.6 | 2349.4 |
| REQDQ | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10951.0 | 3465.3 | 3068.9 | 4021.6 | 2348.4 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 3045015. | 3408230. | 4180484. | 4035704. | 3672339. | 3149760. | 2614308. | 2100950. | 2051690. | 2057342. | 2115275. | 2344018. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 45.8 |
| TMPIN | 50.4 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 48.9 | 43.1 |
| TMPMX | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 49.6 | 47.3 | 48.5 | 50.9 | 52.8 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 49.1 |
| TMPMN | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESM | | 46.9 | 48.5 | 51.8 | 53.4 | 52.1 | 50.5 | 50.5 | 50.4 | 49.3 | 51.4 | 50.1 | 48.3 |
| RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 448.6 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.3 | 0.0 |
| RELEASES THRU OUTLET 2 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6958.2 | 3436.0 | 2591.5 | 3191.6 | 353.6 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.7 | 45.8 | 46.4 | 49.7 | 49.0 |
| RELEASES THRU OUTLET 3 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3391.0 | 3901.5 | 29.3 | 567.4 | 391.4 | 340.9 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46.5 | 54.8 | 69.5 | 65.7 | 57.8 | 51.0 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 278.6 | 2039.8 | 81.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46.0 | 49.9 | 62.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 5 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6656.1 | 1644.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1174.2 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.5 | 54.8 | 0.0 | 0.0 | 0.0 | 0.0 | 49.0 |
| RELEASES THRU OUTLET 6 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 2916.3 | 4953.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 469.7 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 47.2 | 51.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.9 |
| RELEASES THRU OUTLET 7 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 4168.3 | 2222.9 | 0.0 | 1897.2 | 6908.4 | 89.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 47.3 | 48.5 | 0.0 | 48.1 | 51.9 | 59.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 8 | | | | | | | | | | | | | |
| QQMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 238.5 | 2039.4 | 6636.7 | 538.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 40.9 | 50.9 | 54.1 | 60.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

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 TOUTL    .    0.0    40.9    50.9    54.1    60.3    0.0    0.0    0.0
1
0END-OF-FILE ENCOUNTERED, FILENAME -    SHAS87
 ERROR NUMBER   65   DETECTED BY INPC=   AT ADDRESS 000151
 CALLED FROM C095    AT  LINE 51
     2.122 CP SECONDS EXECUTION TIME.


run
         MO  AB.S.C.   S.C.    KES.    C.C.    R.B.

          1    46.9    44.0    46.9    46.3    45.8
          2    48.5    44.0    47.6    47.7    47.7
          3    51.8    45.5    50.0    51.3    52.3
          4    53.4    46.7    53.4    54.6    55.8
          5    52.1    46.9    52.0    54.1    55.9
          6    50.5    47.9    50.4    53.2    55.7
          7    50.5    54.2    51.2    53.5    55.7
          8    50.4    57.2    51.0    53.4    55.7
          9    49.3    53.1    51.1    53.8    56.2
         10    51.4    51.6    51.5    52.8    54.0
         11    50.1    49.0    49.9    50.0    50.1
         12    48.3    44.6    47.2    46.4    45.7

SRU     1.100 UNTS.

 RUN COMPLETE.



1
                         SHASTA LAKE TEMPERATURE PREDICTIONS
                         TEMPERATURE CONTROL STUDY: SKIM-815-1025 [illegible]
                         AUGUST 14, 1987 FORECAST: JAN 87 - JUL 89
0THE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

    NYR     IYR    NPER    IPER   MSTRT   NLAYR   LAYER   NOUTL   NMINO   IDERV   METRC   IDUST     NIC     NIT    NOTL   INTER
      1    1987      12       1       1      97       5       7       0       0       0       0       1       0       0      10
   MREL     NMO
      0       3


    STORA      CISA      COSA   STRMX   STRMN     TIN    TAIR    EVAP    PRCP    DMIN    TMAX    TMIN   CSOUT    SOLR     DEP
 2973200.-1000.000-1000.0004950000.      0.     -1.     -1.   -2.00   -2.00     -2.     -1.     -1.    .504     -1.   32.81
0      AIR TEMP COEF    INFLO MIXING COEF      DIFFUSION COEF       EVAP HEAT COEF      INSOLATION COEF
          1.000                .048                 .013                 .655                 .155

 STCAP=      495.      806.     1234.     1801.     2531.     3449.     4578.     5931.     7518.     9341.
           11404.    13721.    16318.    19234.    22507.    26171.    30251.    34766.    39735.    45173.
           51102.    57541.    64522.    72089.    80306.    89247.    98967.   109592.   121069.   133466.
          146785.   161066.   176346.   192688.   210146.   228752.   248514.   269414.   291443.   314621.
          339002.   364674.   391736.   420274.   450366.   482176.   515543.   550512.   587127.   625450.
          665511.   707355.   751027.   796358.   843589.   892763.   943929.   996795.  1051713.  1108729.
         1167888.  1228773.  1291854.  1357174.  1424780.  1494336.  1566238.  1640529.  1717255.  1795883.
```

```
   1167888.  1228773.  1291854.  1357174.  1424789.  1494336.  1565239.  1640529.  [illegible]  [illegible]
   1876996.  1960627.  2046829.  2135150.  2226093.  2319700.  2416019.  2514929.  2616522.  2721148.
   2828544.  2938672.  3051750.  3167820.  3286929.  3408655.  3533479.  3661442.  3792590.  [illegible]
   4063108.  4203254.  4346717.  4492742.  4642178.  4794960.  4950723.

TSTRT=     45.0      45.0      45.0      45.0      45.0      45.1      45.1      45.1      45.1      45.1
           45.2      45.2      45.2      45.3      45.3      45.3      45.4      45.4      45.4      45.5
           45.5      45.5      45.5      45.6      45.6      45.6      45.7      45.7      45.7      45.9
           45.8      46.0      46.2      46.4      46.6      46.7      46.9      46.9      47.0      47.0
           47.0      47.2      47.5      47.8      48.1      48.4      48.6      48.7      48.8      48.9
           48.9      49.0      49.1      49.2      49.3      49.4      49.5      49.6      49.7      49.9
           50.1      50.1      50.2      50.3      50.3      50.4      50.4      50.5      50.5      50.6
           50.6      50.6      50.7      50.7      50.8      50.8      50.9      50.9      50.9      51.0
           51.0      51.0      51.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0
           -1.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0

STOUT=   420274.  1167888.  1494336.  1876996.  2319700.  2828544.  3408655.

                                          RESERVOIR TEMPERATURES
YEAR  PER    1     2     3     4     5     6     7     8     9    10    11    12    13    14    15    16    17    18    19    20
1987   1  45.0  45.0  45.0  45.0  45.0  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2
          45.2  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.6  45.6  45.6  45.7  45.7  45.8  45.8
          45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9
          45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9
          45.9  45.9  45.9
1987   2  45.0  45.0  45.0  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2
          45.2  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.6  45.6  45.6  45.7  45.7  45.7  45.7
          45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.8  45.8  45.8  45.8  45.8  45.8  45.9  45.9
          45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  46.0  46.1  46.2  46.6
          47.4  48.2  48.7  48.8  48.9  48.9
1987   3  45.0  45.0  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2
          45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.7
          45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8
          45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  46.0  46.0  46.1  46.2  46.4  46.6  47.0
          47.5  47.6  47.7  47.7  47.9  48.4  49.7  50.8  51.3  51.5  51.5  51.6
1987   4  45.0  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2
          45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.7
          45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.9  45.8
          45.8  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  46.0  46.0  46.1  46.3  46.4  46.6  46.9  47.2
          47.7  48.6  49.3  50.3  52.0  54.2  55.8  57.8  59.1  59.3  59.3
1987   5  45.0  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3
          45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.7
          45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8
          45.8  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  46.0  46.0  46.1  46.2  46.4  46.7  48.0  49.0  50.5  52.9
          56.0  59.2  61.5  63.2  64.2  64.6  64.7  64.8  64.8
1987   6  45.0  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3
          45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.6  45.6  45.7  45.7
          45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8
          45.8  45.9  45.9  45.9  45.9  45.9  46.0  46.1  46.3  46.6  47.5  51.7  54.3  57.3  60.3  63.0  65.1  67.7  70.0  71.4
          72.1  72.4  72.6  72.6
1987   7  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3
          45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.6  45.6  45.7  45.7
          45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.7  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.9  45.9  46.0
          46.2  47.7  49.5  52.9  56.8  60.2  62.8  65.1  67.4  69.4  70.7  72.4  74.9  77.3  79.6  79.3  79.6  79.7  79.8
1987   8  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3
          45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.6  45.6  45.7  45.7
          45.7  45.7  45.7  45.7  46.1  46.3  46.5  46.8  47.2  47.8  48.6  49.8  51.6  54.2  57.1  59.7  62.1  64.2  66.2  68.0
          69.1  69.7  70.4  71.4  72.6  73.9  75.3  76.6  77.5  79.0  79.2  79.3  79.3  79.3
1987   9  45.1  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3
          45.3  45.3  45.3  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.6  45.7  45.7  45.8
          45.9  46.1  46.3  46.7  49.9  51.0  52.3  53.8  55.4  57.1  59.9  60.6  62.2  63.6  64.8  65.7  66.2  66.8  67.5  68.2
          69.0  69.8  70.5  71.2  71.8  72.3  72.6  72.9  73.1  73.2  73.3  73.3  73.3  73.3
1987  10  45.1  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3
          45.3  45.3  45.4  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.7  45.8  45.9  46.1  46.5
          47.0  47.6  48.4  49.4  57.2  58.3  59.2  59.7  60.0  60.4  60.9  61.5  62.1  62.7  63.3  63.7  64.0  64.0  64.1  64.1
          64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1
1987  11  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3
          45.3  45.3  45.4  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.6  45.6  45.6  45.7  45.8  45.9  46.1  46.3  46.7  47.2
```

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 11 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.9 | 46.0 | 46.1 | 46.3 | 46.7 | 47.2 |
| | | 47.9 | 48.7 | 49.6 | 50.5 | 52.4 | 52.9 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 |
| | | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | 53.1 | | | | | | |
| 1987 | 12 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 46.0 | 46.0 |
| | | 46.1 | 46.2 | 46.3 | 46.4 | 46.5 | 46.6 | 46.7 | 46.9 | 47.1 | 47.3 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 |
| | | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | 47.5 | | | |

FLOWS AND TEMPERATURES FOR 1987

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 5587.9 | 5366.9 | 9037.2 | 14692.4 | 6255.0 | 4674.1 | 3421.6 | 3659.3 | 2732.3 | 2923.3 | 3252.7 | 5041.7 | 6099.9 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 9.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10951.0 | 3465.3 | 3068.9 | 4021.6 | 2348.4 |
| REQDQ | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10951.0 | 3465.3 | 3068.9 | 4021.6 | 2348.4 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 3045015. | 3408230. | 4180484. | 4035704. | 3672339. | 3148760. | 2614309. | 2100950. | 2051680. | 2057342. | 2115275. | 2344018. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 46.8 |
| TMPIN | 50.4 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 49.8 | 43.1 |
| TMPMX | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 50.0 | 47.3 | 48.5 | 50.9 | 52.8 | 51.0 | 49.0 | 49.0 | 49.0 | 47.3 | 53.3 | 53.2 | 49.9 |
| TMPMN | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESW | | 46.9 | 48.5 | 51.8 | 53.4 | 52.1 | 50.5 | 50.5 | 50.4 | 50.5 | 54.3 | 53.0 | 49.1 |
| :RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7030.5 | 3465.3 | 3068.4 | 4021.6 | 399.5 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.8 | 47.3 | 53.3 | 53.2 | 49.7 |
| RELEASES THRU OUTLET 2 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3391.0 | 3739.3 | 0.0 | .5 | 0.0 | 315.1 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.5 | 51.7 | 0.0 | 49.2 | 0.0 | 50.5 |
| RELEASES THRU OUTLET 3 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 278.0 | 7038.8 | 91.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46.0 | 49.9 | 52.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6656.1 | 1644.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1174.2 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.5 | 51.8 | 0.0 | 0.0 | 0.0 | 0.0 | 49.7 |
| RELEASES THRU OUTLET 5 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 2916.3 | 4953.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 469.7 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 47.2 | 51.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.6 |
| RELEASES THRU OUTLET 6 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 4168.3 | 2222.9 | 0.0 | 1897.2 | 6909.4 | 89.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 47.3 | 48.5 | 0.0 | 48.1 | 51.9 | 59.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 7 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 238.5 | 2039.4 | 6636.7 | 538.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0. | 48.9 | 50.9 | 54.1 | 60.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

1

0END-OF-FILE ENCOUNTERED, FILENAME - SHAS87
ERROR NUMBER 65 DETECTED BY INPC= AT ADDRESS 000151
CALLED FROM C095 AT LINE 51
2.061 CP SECONDS EXECUTION TIME.

run

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 46.9 | 44.0 | 46.9 | 46.3 | 45.8 |
| 2 | 48.5 | 44.0 | 47.6 | 47.7 | 47.7 |
| 3 | 51.8 | 45.5 | 50.0 | 51.3 | 52.3 |
| 4 | 53.4 | 46.7 | 53.4 | 54.6 | 55.8 |
| 5 | 52.1 | 46.9 | 52.0 | 54.1 | 55.9 |
| 6 | 50.5 | 47.9 | 50.4 | 53.2 | 55.7 |
| 7 | 50.5 | 54.2 | 51.2 | 53.5 | 55.7 |
| 8 | 50.4 | 57.2 | 51.0 | 53.4 | 55.7 |
| 9 | 50.5 | 53.1 | 51.8 | 54.4 | 56.7 |
| 10 | 54.3 | 51.6 | 53.1 | 54.2 | 55.2 |
| 11 | 53.0 | 49.0 | 52.1 | 52.0 | 51.9 |
| 12 | 48.1 | 44.6 | 47.0 | 46.3 | 45.6 |

SRU 1.096 UNTS.

RUN COMPLETE.

1

SHASTA LAKE TEMPERATURE PREDICTIONS
TEMPERATURE CONTROL STUDY: BYPASS-750-1025 ~~(50F1 JUL 55F)~~
AUGUST 14, 1987 FORECAST: JAN 87 - JUL 88

0THE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

| NYR | IYR | NPER | IPER | MSTRT | NLAYR | LAYER | NOUTL | NMINO | IPERV | MSTRC | IDGST | NIC | NIT | NOTL | INTER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1987 | 12 | 1 | 1 | 97 | 5 | 8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 |

| MREL | NMO |
|---|---|
| 0 | 3 |

| STORA | CISA | COSA | STRMX | STRMN | TIN | TAIR | EVAP | PRCP | QMIN | TMAX | TMIN | CSOUT | SOLR | DEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2973200. | -1000.000 | -1000.000 | 4950000. | 0. | -1. | -1. | -2.00 | -2.00 | -2. | -1. | -1. | .504 | -1. | 32.91 |

0

| AIR TEMP COEF | INFLO MIXING COEF | DIFFUSION COEF | EVAP HEAT COEF | INSOLATION COEF |
|---|---|---|---|---|
| 1.000 | .048 | .013 | .655 | .155 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STCAP= | 495. | 906. | 1234. | 1801. | 2531. | 3449. | 4579. | 5931. | 7519. | 9341. |
| | 11404. | 13721. | 16318. | 19234. | 22507. | 26171. | 30251. | 34766. | 39735. | 45173. |
| | 51102. | 57541. | 64522. | 72089. | 80306. | 89247. | 99967. | 109592. | 121069. | 133466. |
| | 146785. | 161066. | 176346. | 192688. | 210146. | 228752. | 248514. | 269414. | 291443. | 314621. |
| | 339002. | 364674. | 391736. | 420274. | 450366. | 482176. | 515543. | 550512. | 587127. | 625450. |
| | 665511. | 707355. | 751027. | 796358. | 843599. | 892763. | 943929. | 996795. | 1051713. | 1108729. |
| | 1167888. | 1228773. | 1291854. | 1357174. | 1424780. | 1494336. | 1566278. | 1640529. | 1717255. | 1795893. |
| | 1876996. | 1960627. | 2046829. | 2135150. | 2226093. | 2319700. | 2416019. | 2514929. | 2616622. | 2721146. |
| | 2828544. | 2938672. | 3051750. | 3167820. | 3286929. | 3408655. | 3533478. | 3661442. | 3792590. | 3926232. |
| | 4063108. | 4203254. | 4346717. | 4492742. | 4642178. | 4794960. | 4950723. | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TSTRT= | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 |
| | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 |
| | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 |
| | 45.8 | 46.0 | 46.2 | 46.4 | 46.6 | 46.7 | 46.8 | 46.9 | 47.0 | 47.0 |
| | 47.0 | 47.2 | 47.5 | 47.8 | 48.1 | 48.4 | 48.6 | 48.7 | 48.8 | 48.9 |
| | 48.9 | 49.0 | 49.1 | 49.2 | 49.3 | 49.4 | 49.5 | 49.6 | 49.7 | 49.9 |
| | 50.1 | 50.1 | 50.2 | 50.3 | 50.3 | 50.4 | 50.4 | 50.5 | 50.5 | 50.6 |
| | 50.6 | 50.6 | 50.7 | 50.7 | 50.8 | 50.8 | 50.8 | 50.9 | 50.9 | 51.0 |
| | 51.0 | 51.0 | 51.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 |

-1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0

STOUT= 146785. 420274. 1167889. 1494336. 1876996. 2319700. 2929544. 3409455.

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | | | | | | | | | | | | | | | | | |
| 1987 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.1 | 46.2 | 46.6 |
| | | 47.4 | 48.2 | 48.7 | 48.8 | 49.9 | 48.9 | | | | | | | | | | | | | | |
| 1987 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.6 | 47.0 |
| | | 47.5 | 47.6 | 47.7 | 47.7 | 47.9 | 48.4 | 49.7 | 50.8 | 51.3 | 51.5 | 51.5 | 51.6 | | | | | | | | |
| 1987 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.3 | 46.4 | 46.6 | 46.9 | 47.2 |
| | | 47.7 | 48.6 | 49.3 | 50.3 | 52.0 | 54.2 | 56.8 | 57.8 | 59.1 | 59.3 | 59.3 | | | | | | | | | |
| 1987 | 5 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.7 | 49.0 | 49.0 | 50.5 | 52.9 |
| | | 56.0 | 59.2 | 61.5 | 63.2 | 64.2 | 64.6 | 64.7 | 64.8 | 64.8 | | | | | | | | | | | |
| 1987 | 6 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.1 | 46.3 | 46.6 | 47.5 | 51.7 | 54.3 | 57.3 | 60.3 | 63.0 | 65.1 | 67.7 | 70.0 | 71.4 |
| | | 72.1 | 72.4 | 72.6 | 72.6 | | | | | | | | | | | | | | | | |
| 1987 | 7 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 46.0 |
| | | 46.2 | 47.7 | 49.5 | 52.9 | 56.8 | 60.2 | 62.8 | 65.1 | 67.4 | 69.4 | 70.7 | 72.4 | 74.9 | 77.3 | 78.6 | 79.3 | 79.6 | 79.7 | 79.8 | |
| 1987 | 8 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 46.1 | 46.3 | 46.5 | 46.8 | 47.2 | 47.8 | 48.6 | 49.8 | 51.6 | 54.2 | 57.1 | 59.7 | 62.1 | 64.2 | 66.2 | 68.0 |
| | | 69.1 | 69.7 | 70.4 | 71.4 | 72.6 | 73.9 | 75.3 | 76.6 | 77.5 | 78.0 | 78.2 | 78.3 | 78.3 | 78.3 | | | | | | |
| 1987 | 9 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.7 | 45.7 | 45.8 | 45.8 | 45.9 | 46.0 | 46.2 | 46.4 | 46.7 |
| | | 47.2 | 47.7 | 48.3 | 49.1 | 50.0 | 51.1 | 52.4 | 53.8 | 55.4 | 57.1 | 58.9 | 60.6 | 62.2 | 63.6 | 64.8 | 65.7 | 66.2 | 66.8 | 67.5 | 68.2 |
| | | 69.0 | 69.8 | 70.5 | 71.2 | 71.8 | 72.3 | 72.6 | 72.9 | 73.1 | 73.2 | 73.3 | 73.3 | 73.3 | 73.3 | | | | | | |
| 1987 | 10 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 46.2 | 46.4 | 46.6 | 46.9 | 47.2 | 47.7 | 48.2 | 48.9 | 49.7 |
| | | 50.8 | 52.2 | 53.9 | 55.8 | 57.6 | 58.6 | 59.4 | 59.8 | 60.1 | 60.5 | 60.9 | 61.5 | 62.1 | 62.7 | 63.3 | 63.7 | 64.0 | 64.0 | 64.1 | 64.1 |
| | | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | | | | | | |
| 1987 | 11 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.7 | 45.8 | 46.0 | 46.3 | 46.6 | 51.0 | 51.4 | 51.7 | 51.8 | 51.9 | 52.0 | 52.2 | 52.3 | 52.5 |
| | | 52.7 | 53.0 | 53.1 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 |
| | | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | 53.2 | | | | | | |
| 1987 | 12 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.4 | 45.4 | 45.5 | 45.5 | 45.6 | 45.7 | 45.9 | 46.0 | 46.2 | 46.2 | 46.2 | 46.2 | 46.3 | 46.3 | 46.4 | 46.5 | 46.6 | 46.7 | 46.8 | 46.9 |
| | | 47.0 | 47.2 | 47.4 | 47.6 | 47.7 | 47.7 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 |
| | | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | | | |

FLOWS AND TEMPERATURES FOR 1987

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 5587.9 | 5366.9 | 9037.2 | 14692.4 | 6255.0 | 4674.1 | 3421.6 | 3659.3 | 2732.3 | 2923.3 | 3252.7 | 5041.7 | 6098.8 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 4291.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10851.0 | 3465.3 | 3068.9 | 4021.6 | 2348.4 |
| | | | | | | | | | 0 | 3465.3 | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EVAP | 4.5 | 1.0 | 1.0 | [illegible] | [illegible] | 6.1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10951.0 | 3465.3 | 2968.9 | 4021.6 | 2349.4 |
| REQDQ | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10951.0 | 3465.3 | 2968.9 | 4021.6 | 2349.4 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 3045015. | 3408230. | 4180484. | 4035704. | 3672339. | 3149760. | 2614308. | 2100950. | 2051690. | 2057342. | 2115275. | 2144018. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 92.0 | 90.5 | 75.1 | 64.5 | 51.7 | 45.8 |
| TMPIN | 50.4 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 49.8 | 43.1 |
| TMPMX | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 49.6 | 47.3 | 48.5 | 50.9 | 52.8 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 49.1 |
| TMPMN | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESW | | 46.9 | 48.5 | 51.8 | 53.4 | 52.1 | 50.5 | 50.5 | 50.4 | 49.3 | 51.4 | 50.1 | 49.2 |
| RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2265.1 | 1254.1 | 2968.1 | 314.8 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.6 | 45.9 | 48.0 | 49.7 |
| RELEASES THRU OUTLET 2 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7030.5 | 1200.2 | 1814.9 | 1153.5 | 399.8 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.8 | 46.7 | 52.9 | 55.1 | 51.1 |
| RELEASES THRU OUTLET 3 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3391.0 | 3739.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46.5 | 51.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 278.0 | 7039.8 | 81.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46.0 | 49.9 | 62.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 5 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6656.1 | 1644.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1174.2 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.5 | 54.8 | 0.0 | 0.0 | 0.0 | 0.0 | 49.0 |
| RELEASES THRU OUTLET 6 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 2916.3 | 4953.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 469.7 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 47.2 | 51.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.9 |
| RELEASES THRU OUTLET 7 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 4168.3 | 2222.9 | 0.0 | 1997.2 | 6908.4 | 99.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 47.3 | 48.5 | 0.0 | 49.1 | 51.9 | 59.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 8 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 238.5 | 2039.4 | 6636.7 | 538.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 48.9 | 50.9 | 54.1 | 60.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

1

```
0END-OF-FILE ENCOUNTERED, FILENAME -     SHAS87
 ERROR NUMBER   65   DETECTED BY INPC=   AT ADDRESS 000151
 CALLED FROM C095    AT  LINE 51
     2.100 CP SECONDS EXECUTION TIME.
```

rud

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 46.9 | 44.0 | 46.9 | 46.3 | 45.8 |
| 2 | 48.5 | 44.0 | 47.6 | 47.7 | 47.7 |
| 3 | 51.8 | 45.5 | 50.0 | 51.3 | 52.3 |
| 4 | 53.4 | 46.7 | 53.4 | 54.6 | 55.8 |
| 5 | 52.1 | 46.9 | 52.0 | 54.1 | 55.9 |

```
  6     50.5     47.9     50.4     53.2     55.7
  7     50.5     54.2     51.2     53.5     55.7
  8     50.4     57.2     51.0     53.4     55.7
  9     49.3     53.1     51.1     53.8     56.2
 10     51.4     51.6     51.5     52.8     54.0
 11     50.1     49.0     49.9     50.0     50.1
 12     48.2     44.6     47.1     46.3     45.7

SRU       1.097 UNTS.

 RUN COMPLETE.



old,shas87
 READY.



1
                    SHASTA LAKE TEMPERATURE PREDICTIONS
                    TEMPERATURE CONTROL STUDY: POWER-815 (50F) JUL 88
                    AUGUST 14, 1987 FORECAST: JAN 87 - JUL 89
OTHE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS. EVAP AND PRECIP IN INCHES. STORAGE IN AF. AND TEMPERATURE IN DEGREES F

   NYR    IYR   NPER   IPER  MSTRT  NLAYR  LAYER  NOUTL  NMINO  IDERV  METRC  IDGST    NIC    NIT   NOTL  INTER
     1   1987     12      1      1     97      5      1      0      0      0      0      1      0      0     10
  MREL    NMO
     0      3

   STORA     CISA     COSA   STRMX   STRMN     TIN    TAIR    EVAP    PRCP    QMIN    TMAX    TMIN   CSOUT    SOLR     DEP
 2973200.-1000.000-1000.0004950000.     0.     -1.     -1.   -2.00   -2.00     -2.     -1.     -1.    .504     -1.   32.81
0      AIR TEMP COEF    INFLO MIXING COEF      DIFFUSION COEF        EVAP HEAT COEF     INSOLATION COEF
          1.000                .048                 .013                  .655                .155

 STCAP=      495.      806.     1234.     1801.     2531.     3449.     4579.     5931.     7518.     9341.
           11404.    13721.    16318.    19234.    22507.    26171.    30251.    34765.    39735.    45173.
           51102.    57541.    64522.    72089.    80306.    89247.    98967.   109582.   121069.   133466.
          146785.   161066.   176346.   192698.   210146.   228752.   248514.   269414.   291443.   314621.
          339002.   364674.   391736.   420274.   450366.   482176.   515543.   550512.   587127.   625450.
          665511.   707355.   751027.   796358.   843589.   892763.   943929.   996795.  1051713.  1108729.
         1167888.  1228773.  1291854.  1357174.  1424780.  1494336.  1566238.  1640529.  1717255.  1795983.
         1876996.  1960627.  2046829.  2135150.  2226093.  2319700.  2415919.  2514929.  2616622.  2721146.
         2828544.  2938672.  3051750.  3167820.  3286929.  3408655.  3533479.  3661442.  3792590.  3926232.
         4063108.  4203254.  4346717.  4492742.  4642178.  4794960.  4950723.

 TSTRT=      45.0      45.0      45.0      45.0      45.0      45.1      45.1      45.1      45.1      45.1
             45.2      45.2      45.2      45.3      45.3      45.3      45.4      45.4      45.4      45.5
             45.5      45.5      45.5      45.6      45.6      45.6      45.7      45.7      45.7      45.8
             45.8      46.0      46.2      46.4      46.6      46.7      46.8      46.9      47.0      47.0
             47.0      47.2      47.5      47.8      48.1      48.4      48.6      48.7      48.8      48.9
             48.9      49.0      49.1      49.2      49.3      49.4      49.5      49.6      49.7      49.9
             50.1      50.1      50.2      50.3      50.3      50.4      50.4      50.5      50.5      50.6
             50.6      50.6      50.7      50.7      50.8      50.8      50.8      50.9      50.9      51.0
             51.0      51.0      51.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0
             -1.0      -1.0      -1.0      -1.0      -1.0      -1.0      -1.0

 STOUT=   420274.

                                        PREDICTED TEMPERATURES
```

STOUT= 420774.

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | | | | | | | | | | | | | | | | | |
| 1987 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.3 | 46.6 | 47.1 |
| | | 47.8 | 48.4 | 48.7 | 48.9 | 48.9 | 48.9 | | | | | | | | | | | | | | |
| 1987 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.3 | 46.4 | 46.7 | 46.9 | 47.2 | 47.5 |
| | | 47.6 | 47.7 | 47.8 | 47.9 | 48.3 | 49.0 | 50.1 | 50.9 | 51.3 | 51.5 | 51.6 | 51.6 | | | | | | | | |
| 1987 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.7 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 46.0 | 46.0 | 46.0 | 46.1 | 46.1 | 46.2 | 46.3 | 46.4 | 46.6 | 46.8 | 46.9 | 47.1 | 47.3 | 47.6 | 47.8 | 48.1 | 48.4 | 48.9 | 49.5 |
| | | 50.4 | 51.2 | 52.0 | 53.0 | 54.6 | 56.2 | 57.4 | 58.0 | 59.2 | 59.3 | 59.4 | | | | | | | | | |
| 1987 | 5 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.7 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.1 | 46.1 | 46.1 | 46.2 | 46.3 | 46.3 | 46.4 | 46.5 | 46.6 |
| | | 46.7 | 46.8 | 47.0 | 47.1 | 47.3 | 47.5 | 47.7 | 48.0 | 48.2 | 48.6 | 49.0 | 49.5 | 50.0 | 50.7 | 51.5 | 52.3 | 53.4 | 54.6 | 55.9 | 57.0 |
| | | 58.2 | 60.1 | 62.1 | 63.5 | 64.3 | 64.6 | 64.8 | 64.8 | 64.8 | | | | | | | | | | | |
| 1987 | 6 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 |
| | | 45.8 | 45.8 | 45.9 | 45.9 | 46.8 | 46.9 | 46.9 | 47.0 | 47.1 | 47.2 | 47.3 | 47.4 | 47.6 | 47.7 | 47.9 | 49.0 | 48.2 | 49.5 | 48.7 | 49.0 |
| | | 49.4 | 49.8 | 50.2 | 50.7 | 51.3 | 51.9 | 52.7 | 53.5 | 54.4 | 55.4 | 56.5 | 57.7 | 59.0 | 60.6 | 62.4 | 64.0 | 65.8 | 69.1 | 70.3 | 71.6 |
| | | 72.2 | 72.5 | 72.6 | 72.6 | | | | | | | | | | | | | | | | |
| 1987 | 7 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.9 |
| | | 46.0 | 46.2 | 46.4 | 46.6 | 49.8 | 50.0 | 50.3 | 50.6 | 50.9 | 51.2 | 51.6 | 52.0 | 52.4 | 52.9 | 53.4 | 53.9 | 54.5 | 55.2 | 56.0 | 56.8 |
| | | 57.7 | 58.6 | 59.7 | 60.9 | 62.2 | 63.6 | 65.0 | 66.7 | 69.5 | 70.0 | 71.0 | 72.7 | 75.2 | 77.4 | 79.7 | 79.3 | 79.6 | 79.7 | 79.8 | |
| 1987 | 8 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 45.9 | 46.1 | 46.4 |
| | | 46.9 | 47.4 | 48.0 | 48.7 | 57.3 | 57.9 | 59.5 | 59.1 | 59.7 | 60.4 | 61.1 | 61.9 | 62.7 | 63.5 | 64.4 | 65.4 | 66.4 | 67.4 | 68.4 | 69.2 |
| | | 69.7 | 70.1 | 70.9 | 71.8 | 72.9 | 74.1 | 75.5 | 75.7 | 77.6 | 79.0 | 79.2 | 79.3 | 79.3 | 79.3 | | | | | | |
| 1987 | 9 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 46.0 | 46.1 | 46.4 | 46.8 | 47.5 |
| | | 48.4 | 49.4 | 50.6 | 51.9 | 60.4 | 61.3 | 62.1 | 62.9 | 63.7 | 64.4 | 65.0 | 65.6 | 66.1 | 66.4 | 66.7 | 67.1 | 67.6 | 68.1 | 68.7 | 69.2 |
| | | 69.8 | 70.4 | 71.0 | 71.6 | 72.1 | 72.5 | 72.7 | 73.0 | 73.1 | 73.2 | 73.3 | 73.3 | 73.3 | 73.3 | | | | | | |
| 1987 | 10 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.8 | 45.9 | 46.1 | 46.3 | 46.7 | 47.1 | 47.8 | 48.7 |
| | | 49.9 | 51.2 | 52.6 | 54.2 | 60.5 | 60.9 | 61.6 | 62.2 | 62.9 | 63.4 | 63.8 | 64.1 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 |
| | | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | 64.2 | | | | | | |
| 1987 | 11 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.7 | 45.7 | 45.9 | 46.0 | 46.2 | 46.5 | 46.8 | 47.2 | 47.8 | 49.5 | 49.3 |
| | | 50.3 | 51.3 | 51.5 | 51.8 | 53.0 | 53.2 | 53.2 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 |
| | | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | 53.3 | | | | | | |
| 1987 | 12 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.7 | 45.7 | 45.8 | 46.0 | 46.0 | 46.0 | 46.1 | 46.1 | 46.1 | 46.2 | 46.3 | 46.3 |
| | | 46.4 | 46.5 | 46.6 | 46.8 | 47.0 | 47.3 | 47.5 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 |
| | | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | 47.6 | | | |

FLOWS AND TEMPERATURES FOR 1987

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 5587.9 | 5366.9 | 9037.2 | 14692.4 | 6255.0 | 4674.1 | 3421.6 | 3659.3 | 2732.3 | 2823.3 | 3252.7 | 5041.7 | 6098.8 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10851.0 | 3465.3 | 3068.9 | 4021.6 | 2348.4 |
| REQDQ | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10851.0 | 3465.3 | 3068.9 | 4021.6 | 2348.4 |
| | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REQHR | 6281.1 | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10851.0 | 3465.3 | 3068.9 | 4021.6 | 2349.4 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 3045015. | 3408230. | 4180484. | 4035704. | 3672339. | 3149760. | 2614308. | 2100950. | 2051680. | 2057342. | 2115275. | 2344018. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 46.8 |
| TMPIN | 50.4 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 48.9 | 43.1 |
| TMPMX | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 49.0 | 46.8 | 45.8 | 45.8 | 45.8 | 45.9 | 46.2 | 47.9 | 52.8 | 59.3 | 60.5 | 53.9 | 49.7 |
| TMPMN | 50.4 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESW | | 46.5 | 46.1 | 47.5 | 46.8 | 47.2 | 47.9 | 49.4 | 54.1 | 60.2 | 60.8 | 53.6 | 47.9 |

RELEASES THRU OUTLET 1

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QQMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 4168.3 | 2461.4 | 2039.4 | 8533.9 | 10363.1 | 11977.3 | 12074.0 | 10851.0 | 3465.3 | 3068.9 | 4021.6 | 2349.4 |
| TOUTL | 46.8 | 45.8 | 45.8 | 45.8 | 45.9 | 46.2 | 47.9 | 52.8 | 59.3 | 60.5 | 53.9 | 49.7 |

```
1
OEND-OF-FILE ENCOUNTERED, FILENAME -     SHAS87
 ERROR NUMBER   65    DETECTED BY INPC=    AT ADDRESS 000151
 CALLED FROM C095     AT  LINE 51
     2.135 CP SECONDS EXECUTION TIME.
```

: run

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 46.5 | 44.0 | 46.5 | 45.9 | 45.5 |
| 2 | 46.1 | 44.0 | 45.7 | 46.1 | 46.4 |
| 3 | 47.5 | 45.5 | 46.9 | 48.8 | 50.3 |
| 4 | 46.8 | 46.7 | 46.8 | 48.7 | 50.3 |
| 5 | 47.2 | 46.9 | 47.2 | 49.7 | 51.9 |
| 6 | 47.9 | 47.9 | 47.9 | 50.9 | 53.6 |
| 7 | 49.4 | 54.2 | 50.2 | 52.7 | 54.9 |
| 8 | 54.1 | 57.2 | 54.4 | 56.5 | 58.6 |
| 9 | 60.2 | 53.1 | 56.9 | 58.8 | 60.6 |
| 10 | 60.8 | 51.6 | 56.6 | 57.3 | 57.9 |
| 11 | 53.6 | 49.0 | 52.6 | 52.5 | 52.3 |
| 12 | 47.9 | 44.6 | 46.9 | 46.1 | 45.5 |

SRU 1.097 UNITS.

RUN COMPLETE.

SHASTA LAKE TEMPERATURE PREDICTIONS
TEMPERATURE CONTROL STUDY: SKIM-815-1035 ~~[illegible]~~
1976

0THE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

| NYR | IYR | NPER | IPER | MSTRT | NLAYR | LAYER | NOUTL | NMINQ | IDERV | METRC | IDGST | NIC | NIT | NOTL | INTER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1976 | 12 | 1 | 1 | 97 | 5 | 7 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 |

| MREL | NMO |
|---|---|
| 0 | 3 |

| STORA | CISA | COSA | STRMX | STRMN | TIN | TAIR | EVAP | PRCP | QMIN | TMAX | TMIN | CSOUT | SOLR | DEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3036900. | -1000.000 | -1000.000 | 4950000. | 0. | -1. | -1. | -2.00 | -2.00 | -2. | -1. | -1. | .504 | -1. | 32.81 |

0

| AIR TEMP COEF | INFLO MIXING COEF | DIFFUSION COEF | EVAP HEAT COEF | INSOLATION COEF |
|---|---|---|---|---|
| 1.000 | .048 | .013 | .655 | .155 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STCAP= | 495. | 806. | 1234. | 1801. | 2531. | 3449. | 4578. | 5931. | 7518. | 9341. |
| | 11404. | 13721. | 16318. | 19234. | 22507. | 26171. | 30251. | 34766. | 39735. | 45173. |
| | 51102. | 57541. | 64522. | 72089. | 80306. | 89247. | 98967. | 109582. | 121069. | 133466. |
| | 146785. | 161066. | 176346. | 192688. | 210146. | 228752. | 248514. | 269414. | 291443. | 314621. |
| | 339002. | 364674. | 391736. | 420274. | 450366. | 482176. | 515543. | 550512. | 587127. | 625450. |
| | 665511. | 707355. | 751027. | 796358. | 843589. | 892763. | 943929. | 996795. | 1051713. | 1108729. |
| | 1167888. | 1228773. | 1291854. | 1357174. | 1424780. | 1494336. | 1566238. | 1640529. | 1717255. | 1795883. |
| | 1876996. | 1960627. | 2046829. | 2135150. | 2226093. | 2319700. | 2416019. | 2514928. | 2616622. | 2721146. |
| | 2828544. | 2938672. | 3051750. | 3167820. | 3286929. | 3408655. | 3533478. | 3661442. | 3792590. | 3926232. |
| | 4063108. | 4203254. | 4346717. | 4492742. | 4642178. | 4794860. | 4950723. | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TSTRT= | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 |
| | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 |
| | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 |
| | 45.8 | 46.0 | 46.2 | 46.4 | 46.6 | 46.7 | 46.8 | 46.9 | 47.0 | 47.0 |
| | 47.0 | 47.2 | 47.5 | 47.8 | 48.1 | 48.4 | 48.6 | 49.7 | 49.8 | 48.9 |
| | 48.9 | 49.0 | 49.1 | 49.2 | 49.3 | 49.4 | 49.5 | 49.6 | 49.7 | 49.9 |
| | 50.1 | 50.1 | 50.2 | 50.3 | 50.3 | 50.4 | 50.4 | 50.5 | 50.5 | 50.6 |
| | 50.6 | 50.6 | 50.7 | 50.7 | 50.8 | 50.8 | 50.8 | 50.9 | 50.9 | 51.0 |
| | 51.0 | 51.0 | 51.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 |
| | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | | | |

STOUT= 420274. 1167888. 1494336. 1876996. 2319700. 2828544. 3408655.

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.9 | 45.9 | 45.9 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | | | | | | | | | | | | | | | | | |
| 1976 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.9 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.5 | 47.2 | 48.0 | 48.5 |
| | | 48.8 | 48.9 | 48.9 | | | | | | | | | | | | | | | | | |
| 1976 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.6 | 46.9 | 47.5 | 48.0 | 49.0 | 50.1 |
| | | 50.9 | 51.4 | 51.5 | 51.6 | | | | | | | | | | | | | | | | |
| 1976 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.1 | 46.3 | 46.5 | 46.8 | 47.3 | 49.0 | 48.8 | 53.7 | 55.7 | 57.0 | 57.8 |

Exhibit 2

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 58.1 | 58.3 | 58.3 | | | | | | | | | | | | | | | | | |
| 1976 | 5 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.2 | 46.9 | 47.4 | 49.6 | 51.4 | 55.1 | 59.7 | 61.1 | 63.0 | 64.0 | 64.4 | 64.6 | 64.7 | 64.7 | |
| 1976 | 6 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.1 | 46.2 | 46.5 | 46.9 |
| | | 49.3 | 54.4 | 57.7 | 61.0 | 63.2 | 64.3 | 66.4 | 69.9 | 70.8 | 71.8 | 72.2 | 72.4 | 72.5 | 72.5 | | | | | | |
| 1976 | 7 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 |
| | | 45.8 | 45.8 | 45.9 | 46.0 | 49.1 | 49.8 | 49.7 | 51.0 | 52.6 | 54.6 | 56.8 | 59.0 | 61.1 | 63.0 | 64.7 | 66.5 | 69.5 | 70.0 | 70.7 | 72.0 |
| | | 74.1 | 76.5 | 78.3 | 79.1 | 79.4 | 79.6 | 79.6 | 79.7 | | | | | | | | | | | | |
| 1976 | 8 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.9 | 46.3 | 46.8 |
| | | 47.5 | 48.5 | 49.6 | 50.9 | 68.6 | 68.9 | 69.1 | 69.4 | 69.8 | 70.3 | 70.9 | 71.6 | 72.4 | 73.3 | 74.4 | 75.6 | 76.7 | 77.5 | 77.8 | 78.0 |
| | | 78.1 | 78.1 | 78.1 | | | | | | | | | | | | | | | | | |
| 1976 | 9 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.8 | 45.9 | 46.1 | 46.4 | 46.9 | 47.5 | 48.5 |
| | | 49.9 | 51.5 | 53.3 | 55.4 | 65.6 | 66.5 | 67.4 | 68.3 | 69.0 | 69.7 | 70.3 | 70.8 | 71.3 | 71.7 | 72.0 | 72.3 | 72.6 | 72.9 | 73.0 | 73.1 |
| | | 73.2 | 73.2 | | | | | | | | | | | | | | | | | | |
| 1976 | 10 | 45.1 | 45.1 | 45.2' | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.9 | 45.9 | 46.1 | 46.3 | 46.7 | 47.1 | 47.7 | 48.6 | 49.7 |
| | | 51.0 | 52.6 | 54.2 | 56.0 | 58.4 | 58.5 | 58.9 | 59.5 | 60.4 | 61.5 | 62.5 | 63.3 | 63.6 | 63.8 | 63.8 | 63.8 | 63.9 | 63.9 | 63.9 | 63.9 |
| | | 63.9 | 63.9 | 63.9 | 63.9 | 63.9 | | | | | | | | | | | | | | | |
| 1976 | 11 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 |
| | | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.8 | 45.9 | 46.0 | 46.2 | 46.4 | 46.8 | 47.2 | 47.7 | 48.3 | 49.0 | 49.9 |
| | | 50.7 | 50.8 | 51.0 | 51.2 | 51.9 | 52.3 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 |
| | | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | 52.4 | | | | | | | | | | | | | | |
| 1976 | 12 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 |
| | | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.9 | 45.9 | 46.0 | 46.1 | 46.2 | 46.3 |
| | | 46.4 | 46.6 | 46.8 | 47.0 | 47.2 | 47.2 | 47.2 | 47.2 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 |
| | | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | 47.3 | | | | | | | | | | | | | |

FLOWS AND TEMPERATURES FOR 1976

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 4699.1 | 4591.2 | 4604.6 | 7090.9 | 6576.0 | 4958.7 | 3771.2 | 3491.8 | 4033.3 | 3819.9 | 3219.7 | 3961.9 | 3771.5 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.9 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11245.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3169.1 |
| REQDQ | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11245.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3169.1 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 2989915. | 3032031. | 3141440. | 2997337. | 2540836. | 2092063. | 1602704. | 1248680. | [illegible] | 1419304. | 1486521. | 1522199. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | [illegible] | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 46.8 |
| TMPIN | 52.2 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 49.8 | 43.1 |
| TMPMX | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 52.1 | 47.3 | 48.8 | 51.3 | 53.0 | 51.0 | 49.0 | 49.0 | 59.2 | 65.6 | 59.4 | 53.6 | 48.7 |
| TMPMN | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TRESW | | 47.0 | 48.8 | 51.7 | 53.6 | 51.9 | 50.6 | 50.6 | 60.3 | 66.5 | 60.8 | 53.3 | 49.1 |
| RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 508.9 | 9299.3 | 9606.4 | 4065.3 | 609.9 | 2695.6 | 633.6 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.8 | 46.1 | 59.2 | 65.6 | 59.4 | 53.6 | 50.7 |
| RELEASES THRU OUTLET 2 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5518.5 | 1946.9 | 19.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.6 | 62.6 | 75.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 3 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 1846.9 | 4800.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2534.5 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 46.4 | 50.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 49.2 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 8128.2 | 297.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 50.1 | 60.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 1846.9 | 4900.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2534.5 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 46.4 | 50.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 49.2 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 8128.2 | 297.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 50.1 | 60.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 5 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 5917.6 | 2230.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 50.7 | 59.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 6 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 5340.9 | 5794.3 | 4905.1 | 3288.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 47.3 | 48.8 | 51.3 | 57.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 7 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

1

```
0END-OF-FILE ENCOUNTERED, FILENAME -     SHAS76
 ERROR NUMBER   65   DETECTED BY INPC=   AT ADDRESS 000151
 CALLED FROM C095     AT  LINE 51
     1.886 CP SECONDS EXECUTION TIME.
```

RUN

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 47.0 | 44.0 | 46.7 | 46.3 | 45.9 |
| 2 | 48.8 | 44.0 | 48.1 | 48.1 | 48.1 |
| 3 | 51.7 | 45.5 | 50.9 | 51.5 | 52.0 |
| 4 | 53.6 | 46.7 | 53.5 | 54.7 | 55.7 |
| 5 | 51.9 | 46.9 | 51.9 | 53.7 | 55.4 |
| 6 | 50.6 | 47.9 | 50.1 | 52.7 | 55.1 |
| 7 | 50.6 | 54.2 | 51.3 | 53.7 | 56.0 |
| 8 | 60.3 | 57.2 | 59.7 | 61.4 | 63.1 |
| 9 | 66.5 | 53.1 | 64.4 | 66.0 | 67.4 |
| 10 | 60.8 | 51.6 | 53.0 | 54.5 | 55.8 |
| 11 | 53.3 | 49.0 | 51.9 | 51.8 | 51.7 |
| 12 | 48.1 | 44.6 | 47.6 | 46.8 | 45.1 |

SRU 1.098 UNITS.

RUN COMPLETE.

IDLE

1

1

SHASTA LAKE TEMPERATURE PREDICTIONS
TEMPERATURE CONTROL STUDY: CURTAIN-650-1025
1976

0THE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

| NYR | IYR | NPER | IPER | MSTRT | NLAYR | LAYER | NOUTL | NMINQ | IDERV | METRC | IDGST | NIC | NIT | NOTL | INTER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1976 | 12 | 1 | 1 | 97 | 5 | 8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 |

| MREL | NMO |
|---|---|
| 0 | 3 |

| STORA | CISA | COSA | STRMX | STRMN | TIN | TAIR | EVAP | PRCP | QMIN | TMAX | TMIN | CSOUT | SOLR | DEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3036900. | -1000.000 | -1000.000 | 4950000. | 0. | -1. | -1. | -2.00 | -2.00 | -2. | -1. | -1. | .504 | -1. | 32.81 |

0

| AIR TEMP COEF | INFLO MIXING COEF | DIFFUSION COEF | EVAP HEAT COEF | INSOLATION COEF |
|---|---|---|---|---|
| 1.000 | .048 | .013 | .655 | .155 |

| STCAP= | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 495. | 806. | 1234. | 1801. | 2531. | 3449. | 4578. | 5931. | 7518. | 9341. |
| | 11404. | 13721. | 16318. | 19234. | 22507. | 26171. | 30251. | 34766. | 39735. | 45173. |
| | 51102. | 57541. | 64522. | 72089. | 80306. | 89247. | 98967. | 109582. | 121069. | 133466. |
| | 146785. | 161066. | 176346. | 192688. | 210146. | 228752. | 248514. | 269414. | 291443. | 314621. |
| | 339002. | 364674. | 391736. | 420274. | 450366. | 482176. | 515543. | 550512. | 587127. | 625450. |
| | 665511. | 707355. | 751027. | 796358. | 843589. | 892763. | 943929. | 996795. | 1051713. | 1108729. |
| | 1167888. | 1228773. | 1291854. | 1357174. | 1424780. | 1494336. | 1566238. | 1640529. | 1717255. | 1795883. |
| | 1876996. | 1960627. | 2046829. | 2135150. | 2226093. | 2319700. | 2416019. | 2514928. | 2616622. | 2721146. |
| | 2828544. | 2938672. | 3051750. | 3167820. | 3286929. | 3408655. | 3533478. | 3661442. | 3792590. | 3926232. |
| | 4063108. | 4203254. | 4346717. | 4492742. | 4642178. | 4794860. | 4950723. | | | |

| TSTRT= | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 |
| | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 |
| | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 |
| | 45.8 | 46.0 | 46.2 | 46.4 | 46.6 | 46.7 | 46.8 | 46.9 | 47.0 | 47.0 |
| | 47.0 | 47.2 | 47.5 | 47.8 | 48.1 | 48.4 | 48.6 | 48.7 | 48.8 | 48.9 |
| | 48.9 | 49.0 | 49.1 | 49.2 | 49.3 | 49.4 | 49.5 | 49.6 | 49.7 | 49.9 |
| | 50.1 | 50.1 | 50.2 | 50.3 | 50.3 | 50.4 | 50.4 | 50.5 | 50.5 | 50.6 |
| | 50.6 | 50.6 | 50.7 | 50.7 | 50.8 | 50.8 | 50.8 | 50.9 | 50.9 | 51.0 |
| | 51.0 | 51.0 | 51.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 |
| | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | | | |

| STOUT= | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 11404. | 146785. | 1167888. | 1494336. | 1876996. | 2319700. | 2828544. | 3408655. |

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.9 | 45.9 | 45.9 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | | | | | | | | | | | | | | | | | |
| 1976 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.5 | 47.2 | 48.0 | 48.5 |
| | | 48.8 | 48.9 | 48.9 | | | | | | | | | | | | | | | | | |
| 1976 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.6 | 46.9 | 47.5 | 48.0 | 49.0 | 50.1 |
| | | 50.9 | 51.4 | 51.5 | 51.6 | | | | | | | | | | | | | | | | |
| 1976 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.1 | 46.3 | 46.5 | 46.8 | 47.3 | 48.0 | 48.8 | 53.7 | 55.7 | 57.0 | 57.8 |
| | | 58.1 | 58.3 | 58.3 | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.6 | 46.9 | 47.5 | 48.0 | 49.0 | 50.1 |
| | | 50.9 | 51.4 | 51.5 | 51.6 | | | | | | | | | | | | | | | | |
| 1976 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.1 | 46.3 | 46.5 | 46.8 | 47.3 | 48.0 | 48.8 | 53.7 | 55.7 | 57.0 | 57.8 |
| | | 58.1 | 58.3 | 58.3 | | | | | | | | | | | | | | | | | |
| 1976 | 5 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.2 | 46.9 | 47.4 | 48.6 | 51.4 | 55.1 | 58.7 | 61.1 | 63.0 | 64.0 | 64.4 | 64.6 | 64.7 | 64.7 | |
| 1976 | 6 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.1 | 46.2 | 46.4 | 46.9 |
| | | 49.2 | 54.4 | 57.7 | 61.0 | 63.2 | 64.3 | 66.4 | 68.9 | 70.8 | 71.8 | 72.2 | 72.4 | 72.5 | 72.5 | | | | | | |
| 1976 | 7 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.1 | 46.2 | 46.3 | 46.4 |
| | | 46.6 | 46.8 | 47.1 | 47.4 | 48.0 | 48.6 | 49.5 | 50.7 | 52.2 | 54.1 | 56.3 | 58.6 | 60.7 | 62.7 | 64.5 | 66.3 | 68.2 | 69.9 | 70.5 | 71.8 |
| | | 74.1 | 76.5 | 78.3 | 79.1 | 79.4 | 79.6 | 79.6 | 79.7 | | | | | | | | | | | | |
| 1976 | 8 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 48.4 | 48.8 | 48.8 | 49.8 | 49.8 | 51.3 | 51.5 | 52.5 | 52.7 |
| | | 53.3 | 53.7 | 54.0 | 55.6 | 55.9 | 56.2 | 56.9 | 58.0 | 58.6 | 59.1 | 59.8 | 60.5 | 61.1 | 61.7 | 62.4 | 63.2 | 63.9 | 64.6 | 65.3 | 66.0 |
| | | 66.7 | 67.4 | 67.9 | 68.4 | 68.7 | 68.9 | 69.0 | 69.2 | 69.5 | 69.9 | 70.5 | 71.1 | 71.9 | 72.9 | 74.0 | 75.3 | 76.5 | 77.4 | 77.8 | 78.0 |
| | | 78.1 | 78.1 | 78.1 | | | | | | | | | | | | | | | | | |
| 1976 | 9 | 45.1 | 45.2 | 45.3 | 45.3 | 45.5 | 45.8 | 46.3 | 47.0 | 47.9 | 48.9 | 49.9 | 64.5 | 64.6 | 64.7 | 64.8 | 64.9 | 65.0 | 65.1 | 65.2 | 65.4 |
| | | 65.5 | 65.6 | 65.7 | 65.8 | 65.9 | 65.9 | 65.9 | 65.9 | 66.0 | 66.0 | 66.0 | 66.0 | 66.0 | 66.1 | 66.1 | 66.2 | 66.3 | 66.4 | 66.5 | 66.8 |
| | | 67.2 | 67.5 | 67.8 | 68.0 | 68.3 | 68.5 | 68.8 | 69.1 | 69.5 | 69.8 | 70.3 | 70.7 | 71.1 | 71.6 | 71.9 | 72.3 | 72.6 | 72.8 | 73.0 | 73.1 |
| | | 73.1 | 73.2 | | | | | | | | | | | | | | | | | | |
| 1976 | 10 | 45.2 | 45.5 | 45.7 | 46.1 | 46.5 | 47.2 | 48.1 | 49.2 | 50.5 | 51.9 | 53.4 | 60.5 | 60.5 | 60.6 | 60.6 | 60.6 | 60.6 | 60.6 | 60.7 | 60.7 |
| | | 60.8 | 60.8 | 60.9 | 60.9 | 61.0 | 61.1 | 61.2 | 61.3 | 61.4 | 61.6 | 61.8 | 62.0 | 62.3 | 62.6 | 63.1 | 63.5 | 63.9 | 64.1 | 64.1 | 64.1 |
| | | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 |
| | | 64.1 | 64.1 | 64.1 | 64.1 | 64.1 | | | | | | | | | | | | | | | |
| 1976 | 11 | 45.5 | 45.9 | 46.5 | 47.0 | 47.6 | 48.3 | 49.1 | 50.0 | 51.0 | 52.0 | 52.2 | 52.2 | 52.4 | 52.4 | 52.6 | 52.8 | 52.9 | 53.1 | 53.4 | 53.5 |
| | | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 |
| | | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 |
| | | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | 53.6 | | | | | | | | | | | | | | |
| 1976 | 12 | 45.7 | 46.2 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.4 | 46.5 | 46.6 | 46.6 | 46.6 | 46.6 |
| | | 46.7 | 46.8 | 46.8 | 46.8 | 47.0 | 47.0 | 47.1 | 47.3 | 47.4 | 47.5 | 47.7 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 |
| | | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 |
| | | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | 47.8 | | | | | | | | | | | | | |

FLOWS AND TEMPERATURES FOR 1976

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 4699.1 | 4591.2 | 6604.6 | 7090.9 | 6576.0 | 4958.7 | 3771.2 | 3491.8 | 4033.3 | 3819.9 | 3818.7 | 3861.9 | 3771.5 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| REUDQ | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 2988915. | 3032031. | 3161440. | 2997337. | 2540836. | 2092063. | 1602704. | 1248680. | 1226173. | 1419304. | 1486524. | 1522198. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 46.8 |
| TMPIN | 52.2 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 48.8 | 43.1 |
| TMPMX | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 50.6 | 47.3 | 48.8 | 51.3 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 58.5 | 61.3 | 54.4 | 49.2 |
| TMPMN | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESW | | 47.0 | 48.8 | 51.7 | 53.6 | 51.9 | 50.6 | 50.6 | 50.6 | 60.1 | 61.8 | 54.1 | 48.6 |
| RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2192.7 | 4065.3 | 609.9 | 2695.6 | 590.5 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.7 | 58.5 | 61.3 | 54.4 | 49.3 |
| RELEASES THRU OUTLET 2 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 494.4 | 9161.0 | 6997.1 | 0.0 | 0.0 | 0.0 | 676.7 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.6 | 45.8 | 48.3 | 0.0 | 0.0 | 0.0 | 50.8 |
| RELEASES THRU OUTLET 3 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5532.5 | 2085.2 | 434.9 | 0.0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5532.5 | 2085.2 | 434.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.6 | 63.1 | 76.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 1846.9 | 4801.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1900.9 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 46.4 | 50.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48.6 |
| RELEASES THRU OUTLET 5 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 8128.2 | 297.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 50.1 | 60.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 6 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 5917.6 | 2230.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 50.7 | 58.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 7 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 5340.9 | 5794.3 | 4905.1 | 3288.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 47.3 | 48.8 | 51.3 | 57.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 8 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

```
1
0END-OF-FILE ENCOUNTERED, FILENAME -     SHAS76
 ERROR NUMBER   65   DETECTED BY INPC=   AT ADDRESS 000151
 CALLED FROM C095    AT  LINE 51
     2.040 CP SECONDS EXECUTION TIME.
```

run

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 47.0 | 44.0 | 46.7 | 46.3 | 45.9 |
| 2 | 48.8 | 44.0 | 48.1 | 48.1 | 48.1 |
| 3 | 51.7 | 45.5 | 50.9 | 51.5 | 52.0 |
| 4 | 53.6 | 46.7 | 53.5 | 54.7 | 55.7 |
| 5 | 51.9 | 46.9 | 51.9 | 53.7 | 55.4 |
| 6 | 50.6 | 47.9 | 50.1 | 52.7 | 55.1 |
| 7 | 50.6 | 54.2 | 51.3 | 53.7 | 56.0 |
| 8 | 50.6 | 57.2 | 52.0 | 54.3 | 56.4 |
| 9 | 60.1 | 53.1 | 59.0 | 61.5 | 63.5 |
| 10 | 61.8 | 51.6 | 53.2 | 54.7 | 55.9 |
| 11 | 54.1 | 49.0 | 52.5 | 52.3 | 52.1 |
| 12 | 48.6 | 44.6 | 48.1 | 47.2 | 46.5 |

SRU      1.098 UNTS.

RUN COMPLETE.

1

SHASTA LAKE TEMPERATURE PREDICTIONS
TEMPERATURE CONTROL STUDY: BYPASS-750-1025
1976

0THE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

| NYR | IYR | NPER | IPER | MSTRT | NLAYR | LAYER | NOUTL | NMINQ | IDERV | METRC | IDGST | NIC | NIT | NOTL | INTER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1976 | 12 | 1 | 1 | 97 | 5 | 8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 |

| MREL | NMO |
|---|---|
| 0 | 3 |

| STORA | CISA | COSA | STRMX | STRMN | TIN | TAIR | EVAP | PRCP | QMIN | TMAX | TMIN | CSOUT | SOLR | DEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3036900. | -1000.000 | -1000.000 | 4950000. | 0. | -1. | -1. | -2.00 | -2.00 | -2. | -1. | -1. | .504 | -1. | 32.81 |

| 0 AIR TEMP COEF | INFLO MIXING COEF | DIFFUSION COEF | EVAP HEAT COEF | INSOLATION COEF |
|---|---|---|---|---|
| 1.000 | .048 | .013 | .655 | .155 |

STCAP=

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 495. | 806. | 1234. | 1801. | 2531. | 3449. | 4578. | 5931. | 7518. | 9341. |
| 11404. | 13721. | 16318. | 19234. | 22507. | 26171. | 30251. | 34766. | 39735. | 45173. |
| 51102. | 57541. | 64522. | 72089. | 80306. | 89247. | 98967. | 109582. | 121069. | 133466. |
| 146785. | 161066. | 176346. | 192688. | 210146. | 228752. | 248514. | 269414. | 291443. | 314621. |
| 339002. | 364674. | 391736. | 420274. | 450366. | 482176. | 515543. | 550512. | 587127. | 625450. |
| 665511. | 707355. | 751027. | 796358. | 843589. | 892763. | 943929. | 996795. | 1051713. | 1108729. |
| 1167888. | 1228773. | 1291854. | 1357174. | 1424780. | 1494336. | 1566238. | 1640529. | 1717255. | 1795883. |
| 1876996. | 1960627. | 2046829. | 2135150. | 2226093. | 2319700. | 2416019. | 2514928. | 2616622. | 2721146. |
| 2828544. | 2938672. | 3051750. | 3167820. | 3286929. | 3408655. | 3533478. | 3661442. | 3792590. | 3926232. |
| 4063108. | 4203254. | 4346717. | 4492742. | 4642178. | 4794860. | 4950723. | | | |

TSTRT=

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 |
| 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.4 | 45.4 | 45.4 | 45.5 |
| 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 |
| 45.8 | 46.0 | 46.2 | 46.4 | 46.6 | 46.7 | 46.8 | 46.9 | 47.0 | 47.0 |
| 47.0 | 47.2 | 47.5 | 47.8 | 48.1 | 48.4 | 48.6 | 48.7 | 48.8 | 48.9 |
| 48.9 | 49.0 | 49.1 | 49.2 | 49.3 | 49.4 | 49.5 | 49.6 | 49.7 | 49.9 |
| 50.1 | 50.1 | 50.2 | 50.3 | 50.3 | 50.4 | 50.4 | 50.5 | 50.5 | 50.6 |
| 50.6 | 50.6 | 50.7 | 50.7 | 50.8 | 50.8 | 50.8 | 50.9 | 50.9 | 51.0 |
| 51.0 | 51.0 | 51.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 |
| -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | | | |

STOUT= 146785. 420274. 1167888. 1494336. 1876996. 2319700. 2828544. 3408655.

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.9 | 45.9 | 45.9 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | | | | | | | | | | | | | | | | | |
| 1976 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.5 | 47.2 | 48.0 | 48.5 |
| | | 48.8 | 48.9 | 48.9 | | | | | | | | | | | | | | | | | |
| 1976 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.1 | 46.2 | 46.4 | 46.6 | 46.9 | 47.5 | 48.0 | 49.0 | 50.1 |
| | | 50.9 | 51.4 | 51.5 | 51.6 | | | | | | | | | | | | | | | | |
| 1976 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 |

```
            45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9
            45.9  45.9  45.9  45.9  45.9  45.9  46.0  46.0  46.0  46.1  46.3  46.5  46.8  47.3  48.0  48.8  53.7  55.7  57.0  57.8
            58.1  58.3  58.3
1976     5  45.0  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.3
            45.4  45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.7  45.7  45.7  45.7  45.8
            45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9  45.9
            45.9  45.9  45.9  46.0  46.0  46.2  46.9  47.4  48.6  51.4  55.1  58.7  61.1  63.0  64.0  64.4  64.6  64.7  64.7
1976     6  45.1  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.4
            45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.7  45.7  45.7  45.7  45.8
            45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.8  45.9  45.9  45.9  45.9  45.9  45.9  46.0  46.1  46.2  46.5  46.9
            49.3  54.4  57.7  61.0  63.2  64.3  66.4  68.9  70.8  71.8  72.2  72.4  72.5  72.5
1976     7  45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.3  45.4
            45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.6  45.7  45.7  45.7  45.7  45.7  45.7  45.8
            45.8  45.8  45.9  46.0  48.1  48.8  49.7  51.0  52.6  54.6  56.8  59.0  61.1  63.0  64.7  66.5  68.5  70.0  70.7  72.0
            74.1  76.5  78.3  79.1  79.4  79.6  79.6  79.7
1976     8  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4
            45.4  45.4  45.4  45.5  45.5  45.5  45.6  45.8  46.0  46.2  46.5  59.3  60.2  61.1  62.0  63.0  63.9  64.8  66.0  66.9
            67.5  68.1  68.5  68.8  69.0  69.1  69.3  69.5  69.8  70.3  70.9  71.6  72.4  73.3  74.4  75.6  76.7  77.5  77.8  78.0
            78.1  78.1  78.1
1976     9  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4
            45.4  45.5  45.6  45.7  45.9  46.4  47.1  48.1  49.3  50.7  52.2  65.7  65.8  66.0  66.1  66.3  66.5  66.6  66.9  67.2
            67.6  67.9  68.1  68.4  68.6  68.8  69.1  69.4  69.8  70.1  70.6  71.0  71.4  71.8  72.1  72.4  72.6  72.9  73.0  73.1
            73.2  73.2
1976    10  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.5  45.5
            45.6  45.8  46.0  46.4  46.8  47.5  48.5  49.8  51.1  52.7  54.3  59.5  59.7  59.8  59.9  60.1  60.3  60.7  61.1  61.6
            62.3  63.1  63.7  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1  64.1
            64.1  64.1  64.1  64.1  64.1
1976    11  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.4  45.4  45.5  45.5  45.6  45.8
            46.0  46.2  46.6  47.0  47.6  48.3  49.2  50.2  51.2  51.6  51.7  52.2  52.8  53.2  53.2  53.2  53.2  53.2  53.2  53.2
            53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2  53.2
            53.2  53.2  53.2  53.2  53.2  53.2
1976    12  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.5  45.6  45.7  45.8  45.9
            46.1  46.1  46.1  46.1  46.2  46.2  46.2  46.3  46.4  46.5  46.6  46.7  46.8  47.0  47.1  47.3  47.5  47.6  47.6  47.6
            47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6  47.6
            47.6  47.6  47.6  47.6  47.6  47.6  47.6
```

FLOWS AND TEMPERATURES FOR 1976

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 4699.1 | 4591.2 | 6604.6 | 7090.9 | 6576.0 | 4958.7 | 3771.2 | 3491.8 | 4033.3 | 3819.9 | 3818.7 | 3861.9 | 3771.5 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| REQDQ | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 2988915. | 3032031. | 3161440. | 2997337. | 2540836. | 2092063. | 1602704. | 1248680. | 1226173. | 1419304. | 1486524. | 1522198. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 46.8 |
| TMPIN | 52.2 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 48.8 | 43.1 |
| TMPMX | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 51.0 | 47.3 | 48.8 | 51.3 | 53.0 | 51.0 | 49.0 | 49.0 | 50.8 | 63.5 | 60.5 | 53.8 | 49.2 |
| TMPMN | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESW | | 47.0 | 48.8 | 51.7 | 53.6 | 51.9 | 50.6 | 50.6 | 52.3 | 64.6 | 61.4 | 53.5 | 48.5 |
| RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6047.4 | 4065.3 | 609.9 | 2695.6 | 733.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48.6 | 63.5 | 60.5 | 53.8 | 50.8 |
| RELEASES THRU OUTLET 2 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 508.9 | 9299.3 | 3559.0 | 0.0 | 0.0 | 0.0 | 217.4 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 45.8 | 46.1 | 54.3 | 0.0 | 0.0 | 0.0 | 50.4 |
| RELEASES THRU OUTLET 3 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5518.5 | 1946.9 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.6 | 62.6 | 75.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RELEASES THRU OUTLET 4 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 1846.9 | 4800.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2217.7 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 46.4 | 50.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48.5 |
| RELEASES THRU OUTLET 5 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 8128.2 | 297.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 50.1 | 60.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 6 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 5917.6 | 2230.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 50.7 | 58.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 7 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 5340.9 | 5794.3 | 4905.1 | 3288.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 47.3 | 48.8 | 51.3 | 57.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| RELEASES THRU OUTLET 8 | | | | | | | | | | | | |
| QOMN | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOUTL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

1
0END-OF-FILE ENCOUNTERED, FILENAME - SHAS76
ERROR NUMBER 65 DETECTED BY INPC= AT ADDRESS 000151
CALLED FROM C095 AT LINE 51
1.947 CP SECONDS EXECUTION TIME.

TWO

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 47.0 | 44.0 | 46.7 | 46.3 | 45.9 |
| 2 | 48.8 | 44.0 | 48.1 | 48.1 | 48.1 |
| 3 | 51.7 | 45.5 | 50.9 | 51.5 | 52.0 |
| 4 | 53.6 | 46.7 | 53.5 | 54.7 | 55.7 |
| 5 | 51.9 | 46.9 | 51.9 | 53.7 | 55.4 |
| 6 | 50.6 | 47.9 | 50.1 | 52.7 | 55.1 |
| 7 | 50.6 | 54.2 | 51.3 | 53.7 | 56.0 |
| 8 | 52.3 | 57.2 | 53.3 | 55.5 | 57.6 |
| 9 | 64.6 | 53.1 | 62.8 | 64.7 | 66.2 |
| 10 | 61.4 | 51.6 | 53.1 | 54.6 | 55.9 |
| 11 | 53.5 | 49.0 | 52.1 | 51.9 | 51.8 |
| 12 | 48.5 | 44.6 | 48.0 | 47.1 | 46.4 |

SRU 1.100 UNTS.

RUN COMPLETE.

1

SHASTA LAKE TEMPERATURE PREDICTIONS
TEMPERATURE CONTROL STUDY: POWER-815

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                    TEMPERATURE CONTROL STUDY: POWER-815
                    1976
OTHE OUTPUT UNITS ON INFLOW AND OUTFLOW ARE IN CFS, EVAP AND PRECIP IN INCHES, STORAGE IN AF, AND TEMPERATURE IN DEGREES F

   NYR     IYR    NPER    IPER   MSTRT   NLAYR   LAYER   NOUTL   NMINQ   IDERV   METRC   IDGST     NIC     NIT    NOTL   INTER
     1    1976      12       1       1      97       5       1       0       0       0       0       1       0       0      10
  MREL     NMO
     0       3

  STORA     CISA     COSA   STRMX   STRMN     TIN    TAIR    EVAP    PRCP    QMIN    TMAX    TMIN   CSOUT    SOLR     DEP
3036900.-1000.000-1000.0004950000.     0.     -1.     -1.   -2.00   -2.00     -2.     -1.     -1.    .504     -1.   32.81
0     AIR TEMP COEF    INFLO MIXING COEF      DIFFUSION COEF       EVAP HEAT COEF      INSOLATION COEF
        1.000               .048                   .013                .655                 .155

STCAP=       495.       806.      1234.      1801.      2531.      3449.      4578.      5931.      7518.      9341.
           11404.     13721.     16318.     19234.     22507.     26171.     30251.     34766.     39735.     45173.
           51102.     57541.     64522.     72089.     80306.     89247.     98967.    109582.    121069.    133466.
          146785.    161066.    176346.    192688.    210146.    228752.    248514.    269414.    291443.    314621.
          339002.    364674.    391736.    420274.    450366.    482176.    515543.    550512.    587127.    625450.
          665511.    707355.    751027.    796358.    843589.    892763.    943929.    996795.   1051713.   1108729.
         1167888.   1228773.   1291854.   1357174.   1424780.   1494336.   1566238.   1640529.   1717255.   1795883.
         1876996.   1960627.   2046829.   2135150.   2226093.   2319700.   2416019.   2514928.   2616622.   2721146.
         2828544.   2938672.   3051750.   3167820.   3286929.   3408655.   3533478.   3661442.   3792590.   3926232.
         4063108.   4203254.   4346717.   4492742.   4642178.   4794860.   4950723.

TSTRT=       45.0       45.0       45.0       45.0       45.0       45.1       45.1       45.1       45.1       45.1
             45.2       45.2       45.2       45.3       45.3       45.3       45.4       45.4       45.4       45.5
             45.5       45.5       45.5       45.6       45.6       45.6       45.7       45.7       45.7       45.8
             45.8       46.0       46.2       46.4       46.6       46.7       46.8       46.9       47.0       47.0
             47.0       47.2       47.5       47.8       48.1       48.4       48.6       48.7       48.8       48.9
             48.9       49.0       49.1       49.2       49.3       49.4       49.5       49.6       49.7       49.9
             50.1       50.1       50.2       50.3       50.3       50.4       50.4       50.5       50.5       50.6
             50.6       50.6       50.7       50.7       50.8       50.8       50.8       50.9       50.9       51.0
             51.0       51.0       51.0       -1.0       -1.0       -1.0       -1.0       -1.0       -1.0       -1.0
             -1.0       -1.0       -1.0       -1.0       -1.0       -1.0       -1.0

STOUT=    420274.
```

RESERVOIR TEMPERATURES

| YEAR | PER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 1 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.9 | 45.9 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 |
| | | 46.0 | 46.0 | 46.0 | | | | | | | | | | | | | | | | | |
| 1976 | 2 | 45.0 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.1 | 46.2 | 46.3 | 46.5 | 46.9 | 47.5 | 48.1 | 48.5 | 48.8 |
| | | 48.9 | 48.9 | 48.9 | | | | | | | | | | | | | | | | | |
| 1976 | 3 | 45.0 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.3 | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 | 45.9 |
| | | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.1 | 46.2 | 46.3 | 46.4 | 46.6 | 46.8 | 47.1 | 47.5 | 47.7 | 48.0 | 48.2 | 48.7 | 49.4 | 50.3 | 51.0 |
| | | 51.3 | 51.5 | 51.5 | 51.6 | | | | | | | | | | | | | | | | |
| 1976 | 4 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 |
| | | 45.8 | 45.8 | 45.9 | 45.9 | 45.9 | 45.9 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.0 | 46.1 | 46.1 | 46.1 | 46.2 | 46.3 | 46.4 | 46.5 |
| | | 46.6 | 46.8 | 46.9 | 47.2 | 47.4 | 47.7 | 48.0 | 48.3 | 48.8 | 49.3 | 50.0 | 50.7 | 51.3 | 51.8 | 52.5 | 53.7 | 55.3 | 56.7 | 57.6 | 58.0 |
| | | 58.2 | 58.3 | 58.3 | | | | | | | | | | | | | | | | | |
| 1976 | 5 | 45.0 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 |
| | | 45.4 | 45.4 | 45.4 | 45.4 | 45.5 | 45.5 | 45.5 | 45.5 | 45.5 | 45.6 | 45.6 | 45.6 | 45.7 | 45.7 | 45.7 | 45.7 | 45.8 | 45.8 | 45.8 | 45.8 |
| | | 45.9 | 45.9 | 45.9 | 46.0 | 46.8 | 46.9 | 47.0 | 47.1 | 47.3 | 47.4 | 47.6 | 47.8 | 47.9 | 48.2 | 48.4 | 48.7 | 49.0 | 49.3 | 49.7 | 50.2 |
| | | 50.7 | 51.2 | 51.8 | 52.4 | 53.1 | 53.9 | 55.1 | 56.3 | 56.8 | 57.4 | 58.5 | 60.3 | 62.2 | 63.5 | 64.2 | 64.5 | 64.7 | 64.7 | 64.7 | |
| 1976 | 6 | 45.1 | 45.1 | 45.1 | 45.1 | 45.1 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.2 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.3 | 45.4 |
| | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 45.7 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

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                45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.7  45.7  45.8  45.8  45.9  46.0
                46.1  46.3  46.5  46.8  50.5  50.8  51.1  51.4  51.8  52.1  52.5  53.0  53.4  54.0  54.6  55.3  56.0  56.8  57.5  58.3
                59.2  60.4  62.0  63.5  64.1  65.2  67.1  69.3  71.0  71.8  72.2  72.4  72.5  72.5
 1976     7     45.1  45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4
                45.4  45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.7  45.7  45.8  45.8  45.9  46.0  46.3  46.6
                47.1  47.8  48.5  49.3  59.4  60.1  60.8  61.5  62.3  63.0  63.8  64.6  65.4  66.4  67.5  68.6  69.7  70.5  71.2  72.5
                74.4  76.6  78.3  79.1  79.5  79.6  79.6  79.7
 1976     8     45.1  45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4
                45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.6  45.7  45.7  45.8  45.8  45.9  46.1  46.3  46.6  47.2  48.1
                49.3  50.7  52.3  54.1  68.9  69.1  69.4  69.8  70.3  70.8  71.3  72.0  72.8  73.6  74.6  75.7  76.8  77.5  77.9  78.0
                78.1  78.1  78.1
 1976     9     45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4
                45.4  45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.7  45.7  45.8  45.9  46.1  46.3  46.6  47.1  47.6  48.5  49.8
                51.4  53.2  55.2  57.4  66.0  66.9  67.9  68.7  69.4  70.1  70.6  71.1  71.5  71.9  72.2  72.4  72.7  72.9  73.0  73.1
                73.2  73.2
 1976    10     45.1  45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4
                45.4  45.4  45.5  45.5  45.5  45.5  45.6  45.6  45.7  45.8  45.9  46.0  46.2  46.5  46.8  47.3  47.9  48.6  49.6  50.9
                52.3  53.9  55.6  57.3  58.5  58.7  59.1  59.7  60.6  61.7  62.7  63.4  63.7  63.8  63.8  63.9  63.9  63.9  63.9  63.9
                63.9  63.9  63.9  63.9  63.9
 1976    11     45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4
                45.4  45.5  45.5  45.5  45.6  45.6  45.7  45.7  45.8  45.9  46.1  46.3  46.5  46.9  47.3  47.8  48.4  49.1  49.9  50.7
                50.8  50.9  51.1  51.4  52.1  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4  52.4
                52.4  52.4  52.4  52.4  52.4  52.4
 1976    12     45.1  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.2  45.3  45.3  45.3  45.3  45.3  45.3  45.3  45.4  45.4  45.4  45.4
                45.5  45.5  45.5  45.6  45.6  45.6  45.6  45.6  45.7  45.7  45.7  45.8  45.8  45.9  46.0  46.0  46.1  46.2  46.3  46.5
                46.6  46.8  47.0  47.2  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3  47.3
                47.3  47.3  47.3  47.3  47.3  47.3  47.3
```

FLOWS AND TEMPERATURES FOR 1976

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INFLO | 4699.1 | 4591.2 | 6604.6 | 7090.9 | 6576.0 | 4958.7 | 3771.2 | 3491.8 | 4033.3 | 3819.9 | 3818.7 | 3861.9 | 3771.5 |
| EVAP | 4.5 | 1.0 | 1.0 | 2.6 | 3.9 | 6.1 | 7.0 | 9.3 | 8.8 | 7.5 | 3.8 | 1.9 | 1.2 |
| PRCP | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| OUTFL | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| REQDQ | 6665.6 | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| STMX | | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. | 4950000. |
| STOR | | 2988915. | 3032031. | 3161440. | 2997337. | 2540836. | 2092063. | 1602704. | 1248680. | 1226173. | 1419304. | 1486524. | 1522198. |
| STMN | | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TA | 62.0 | 44.7 | 48.6 | 51.5 | 58.6 | 65.7 | 73.9 | 82.0 | 80.5 | 75.1 | 64.5 | 51.7 | 46.8 |
| TMPIN | 52.2 | 42.5 | 44.8 | 46.9 | 49.6 | 54.4 | 61.1 | 67.2 | 65.9 | 61.5 | 54.6 | 48.8 | 43.1 |
| TMPMX | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TPOUT | 51.2 | 46.9 | 45.9 | 45.9 | 45.9 | 46.2 | 48.2 | 54.1 | 64.5 | 65.9 | 59.5 | 54.0 | 48.7 |
| TMPMN | 50.9 | 55.0 | 55.0 | 55.0 | 53.0 | 51.0 | 49.0 | 49.0 | 49.0 | 46.0 | 50.0 | 50.0 | 50.0 |
| TKESW | | 46.7 | 46.0 | 46.6 | 46.9 | 47.3 | 49.9 | 55.5 | 65.4 | 66.8 | 60.9 | 53.7 | 48.1 |
| RELEASES THRU OUTLET 1 | | | | | | | | | | | | | |
| QOMN | | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 |
| QOUTL | | 5340.9 | 5794.3 | 4905.1 | 9206.1 | 12205.7 | 11125.3 | 11246.2 | 9624.7 | 4065.3 | 609.9 | 2695.6 | 3168.1 |
| TOUTL | | 46.9 | 45.9 | 45.9 | 45.9 | 46.2 | 48.2 | 54.1 | 64.5 | 65.9 | 59.5 | 54.0 | 48.7 |

```
1
0END-OF-FILE ENCOUNTERED, FILENAME -     SHAS76
 ERROR NUMBER   65   DETECTED BY INPC=   AT ADDRESS 000151
 CALLED FROM C095     AT  LINE 51
     1.937 CP SECONDS EXECUTION TIME.
```

run

| MO | AB.S.C. | S.C. | KES. | C.C. | R.B. |
|---|---|---|---|---|---|
| 1 | 46.7 | 44.0 | 46.4 | 46.0 | 45.7 |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 46.7 | 44.0 | 46.4 | 46.0 | 45.7 |
| 2 | 46.0 | 44.0 | 45.7 | 45.9 | 46.1 |
| 3 | 46.6 | 45.5 | 46.4 | 47.6 | 48.6 |
| 4 | 46.9 | 46.7 | 46.9 | 48.7 | 50.3 |
| 5 | 47.3 | 46.9 | 47.3 | 49.5 | 51.5 |
| 6 | 49.9 | 47.9 | 49.5 | 52.2 | 54.7 |
| 7 | 55.5 | 54.2 | 55.3 | 57.4 | 59.5 |
| 8 | 65.4 | 57.2 | 63.7 | 65.2 | 66.6 |
| 9 | 66.8 | 53.1 | 64.6 | 66.2 | 67.6 |
| 10 | 60.9 | 51.6 | 53.0 | 54.5 | 55.8 |
| 11 | 53.7 | 49.0 | 52.2 | 52.1 | 51.9 |
| 12 | 48.1 | 44.6 | 47.6 | 46.8 | 46.1 |

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RUN COMPLETE.

Appendix 4

Cost Estimates

Cost estimates were prepared by the VE team for those options considered to be the more likely to be adopted.

Option 1. Reservoir Operational Management. - Under this option the only readily identifiable costs would be those associated with the revenue losses from the power that was not generated. It is estimated that cooler water will be released through the outlet works, bypassing the power generation facilities 45 days, once in a 3 year interval, resulting in a loss of power revenues of $3,330,000.

| Year | Power Revenue Loss | PW Factor (0.8875%) | Power Loss (PW Value) |
|---|---|---|---|
| 3 | $3,330,000 | 0.7749 | |
| 6 | $3,330,000 | 0.6004 | |
| 9 | $3,330,000 | 0.4652 | |
| 12 | $3,330,000 | 0.3605 | |
| 15 | $3,330,000 | 0.2794 | |
| 18 | $3,330,000 | 0.2170 | |
| 21 | $3,330,000 | 0.1677 | |
| 24 | $3,330,000 | 0.1300 | |
| 27 | $3,330,000 | 0.1007 | |
| 30 | $3,330,000 | 0.0781 | |
| 33 | $3,330,000 | 0.0605 | |
| 36 | $3,330,000 | 0.0469 | |
| 39 | $3,330,000 | 0.0363 | |
| 42 | $3,330,000 | 0.0282 | |
| 45 | $3,330,000 | 0.0218 | |
| 48 | $3,330,000 | 0.0169 | |
| 51 | $3,330,000 | 0.013 1/ | |

PW Power Revenue Losses = 3.3976 x $3,330,000 = $11,314,000

Annual Cost = 0.0899 X $11,314,000 = $ 1,017,000

These losses were based upon the 1987 season power losses. In 1987, cold water releases were made for 22 days (August 25 through September 15, inclusive, with a volume of 156,690 acre/ft. A power output of 346 kW/hr./acre ft. at a value of 3 cents/kW per hour for a total loss of $1,626,442.20. This figures to $73,929/day, we will use $74,000.

1/ The use of 51 years is recognized to introduce slight inaccuracies, however, annualizing the present worth of this series should minimize these inaccuracies.

Option 2. Installation of Turbines in River Outlets. - A cost estimate for this option was prepared by the VE team with consultation provided by designers from the E&R Center:

| Item | Quantity | Unit Cost | Total |
|---|---|---|---|
| Mobilization | L.S. | | $ 1,000,000 |
| Remove Existing Gates | L.S. | | 300,000 |
| Excavate Concrete | 1,500 $yd^3$ | $ 250/$yd^3$ | 375,000 |
| F&I Turbines & Generators (1,000 $ft^3$/s, 300 ft.TDH) | 20 MW | $1,000,000/MW | 20,000,000 |
| Second Stage Concrete | L.S. | | 50,000 |
| Subtotal | | | $21,725,000 |
| Unlisted Items (10 percent) | | | 2,173,000 |
| Contingencies (25 percent) | | | 5,975,000 |
| Field Cost | | | $29,873,000 |
| Construction Cost | | | $35,847,000 |
| Annual Capital Cost | | | $ 3,227,000 |
| Annual O&M | | | 160,000 |

Power Revenue
  4 units @ 20 MW = 80,000 kW/h
    80,000 kW/h @ 1¢/kW/h X 24 h/day = $19,200/day
  Condition 1, Spills. (estimate 30 days/year)
    30 days X $19,200 = $576,000/year
  Condition 2, Generation during cold water releases
    45 days X $19,200 = $864,000
  Annual value of power generation due to spills
    PW (51 years) = 11.1220 X $576,000 = $6,406,272
    Annual revenue = 0.0899 X 6,406,272 = $576,000
  Cold water releases
    PW (51 years) = 3.3976 X $864,000 = $2,936,000
    Annual revenue = 0,0899 X $2,936,000 = $264,000
  Annual power revenue
    $576,000 + $264,000 = $840,000

Option 3. Curtain-Type Temperature Modification Facility. - The VE team prepared a cost estimate for this facility based upon the narrative description contained in the Conclusions section of the report under Option 3.

| Item | Quantity | Unit Cost | Total |
|---|---|---|---|
| F&I Hypalon Curtain | 240,000 $ft^2$ | $3.00/$ft^2$ | $ 720,000 |
| F&I (1-1/8") Steel Cables | 5,400 lin ft | $ 30/lin ft | $ 162,000 |
| F&I (3/8") Steel Cables | 8,500 lin ft | $4.00 lin ft | $ 34,000 |
| F&I Concrete Anchors | 1,200 $yd^3$ | $ 250/$yd^3$ | $ 300,000 |
| F&I Floats | 335,000 lbs | $3.00/lb | $1,005,000 |
| Cement | 335 tons | $ 100/ton | $ 34,000 |
| F&I Variable Bouyancy Anchors | 110,000 lbs | $3.00/lb | $ 330,000 |
| F&I Nylon Rope (1/4") | 8,000 lin ft | $0.25/lb | $ 2,000 |
| F&I Hydraulic Control System | L.S. | | $ 25,000 |
| Subtotal | | | $2,612,000 |
| Mobilization | | | $ 138,000 |
| | | | $2,750,000 |
| Unlisted Items (10 percent) | | | 275,000 |
| Contingencies (25 percent) | | | $ 760,000 |
| Field Cost | | | $3,785,000 |
| Construction Cost | | | $4,542,000 |
| Annual Capital Cost | | | $ 410,000 |

Replacement Costs

| Item | Frequency of Replacement | PW Factor | PW Cost |
|---|---|---|---|
| F&I Hypalon Curtain | 10 years | 0.739 | $ 530,000 |
| F&I Steel Cables | 10 years | 0.739 | $ 145,000 |
| Concrete Anchors | 50 years | 0 | 0 |
| Concrete Anchors (loss) | 25 percent | .25 | $ 75,000 |
| Floats | 5 years | 1.8643 | $1,874,000 |
| Variable Bouyancy Anchors | 10 years | 0.739 | $ 244,000 |
| Nylon Rope | 5 years | 1.8643 | $ 4,000 |
| Hydraulic Controls | 25 years | 0.1194 | $ 3,000 |
| Present Worth | | | $2,875,000 |
| Replacement Annual Cost | | | $ 259,000 |

Operation and Maintenance Costs

Reposition Curtain
Twice per year, every 2 years
PW 5.3221 X 2 X $5,000 = $53,221
Annual Cost = $4,800

Periodic Inspection
Once per year, every 2 years
PW 5.3221 X $5,000 = $26,610
Annual Cost = $2,400

Total O&M Annual Cost $ 7,000

Option 4. Modify Existing Tower. - The VE Team estimated the costs for making modifications to the existing power penstock intake towers to enable them to be used as a selective level intake.

| Item | Quantity | Unit Cost | Total |
|---|---|---|---|
| Concrete saw cut | 3,900 lin ft | $60/lin ft | $ 234,000 |
| Above waterlevel | | | |
| Below waterlevel | 1,300 lin ft | $240/lin ft | $ 312,000 |
| Remove concrete | 160 $yd^3$ | $300/$yd^3$ | $ 48,000 |
| Above waterlevel | | | |
| Below waterlevel | 55 $yd^3$ | $1,200/$yd^3$ | $ 66,000 |
| F&I Steelguides for covers and shutters | | | |
| Above waterlevel | 51,000 lb | $2.00/lb | $ 102,000 |
| Below waterlevel | 17,000 lb | $8.00/lb | $ 136,000 |
| Furnish fiberglass covers and shutters (1/4 In thick) | 360,000 lb | $4.50/lb | $1,620,000 |
| F&I Trashracks and frames | 390,000 lb | $2.50/lb | $ 975,000 |
| Removing existing trash-racks for modification (hardhat divers) | LS | 500,000 | $ 500,000 |
| Replacing modified trash-racks | LS | 500,000 | $ 500,000 |
| Permanent working platform | 5 ea. | 5,000 | $ 25,000 |
| Subtotal | | | $4,518,000 |
| Mobilization | | | 226,000 |
| Subtotal | | | $4,744,000 |
| Unlisted items (10 percent) | | | 474,000 |
| Subtotal | | | $5,218,000 |
| Contingencies (25 percent) | | | $1,305,000 |
| Field cost | | | $6,523,000 |
| Construction cost | | | $7,828,000 |
| Annual capital cost | | | $ 705,000 |
| O&M costs | | | $ 3,000 |

Power revenue loss during skimming mode (estimated to be 180 days per year every other year). $200,000/year every other year.

PW=200,000X5.3221=$1,064,000

Annual cost $ 96,000

# Appendix 5

## Comments on Value Engineering Study - Draft - September 1987

Comments by Paul Capener

What is reliability of curtain? Will it disintegrate and cause intake problems? What about a portable curtain?

Comments by Jack Rowell

Page 2: The Problem

It may be useful to refer to the September 21, 1987, "Tentative Waste Discharge Requirements for Shasta Unit," developed by the California Regional Water Quality Control Board. The Board is proposing to adopt temperature and turbidity standards for Shasta releases, although the Solicitor's Office will likely object on legal grounds.

Page 2: Desired Reservoir Discharge Procedures

A statement about turbidity control could be inserted here: Surface zone releases, in addition to conserving cooler water, will also provide less turbid releases during the early part of the year. The turbidity of withdrawals can be expected to increase as lower level releases are made for temperature control. As stated in the Tentative Waste Discharge Requirements, however, temperature would have priority over turbidity in cases where the objectives for the two parameters conflict.

Page 5: Conclusions

The curtain-type structure should be designed with enough flexibility to withdraw water of any temperature or turbidity in the water column regardless of the surface water elevation. Therefore, the surface anchor points on the tower and dam must be adjustable in the vertical direction. This would allow additional flexibility in skimming the surface layers of the lake as the water surface elevation drops. The curtain should also allow withdrawals of water from mid-lake levels in cases where a midlevel temperature is desired. Without this ability, water colder than required may be released causing an early depletion of cold water in the lake. Midlevel temperatures can be withdrawn by increasing the bottom aperture area, lowering the top of the curtain, or if necessary, blending top and bottom water by skimming from the surface and releasing from the bottom at the same time.

Page 2: Recommendations

From the standpoint of both temperature and turbidity control and cost the curtain concept appears to be the best design, and thus, should be recommended. The operational flexibility mentioned above should be included in the design.

Determining accomplishments (i.e., temperature and turbidity control) available from the various alternatives was beyond the scope of the VE study. Therefore, math and/or physical model studies may be desirable to determine the optimum design and accomplishments of a curtain device for downstream temperature and turbidity control.

Comments by Jim McHan

The VE group did not appear to determine or estimate the volume of low elevation water needed to accomplish the temperature goal. It would appear from recent operations using the low level outlet that the volume is not as large as some of these designs assume. Modifying one or two existing generating unit water supplies would appear adequate to accomplish the goal. I question whether this was considered in the cost estimate of this alternative. The capital costs were not spread out over their expected life and used in the annual cost. I question the "Do Nothing" alternative energy costs at $288,000. This alternative costs the power users $1,100,000 this year. The curtain alternative presents the greatest risk for failure, but no risk analysis was done to factor this in. I've attached comments from 2 other engineers in my branch. If you have any questions, please contact me at extension 5271.

Comments by Dan Netto

This report does not address the frequency that the river temperature is a problem. Jim Conwell told me it is only a few days every 10 years. I think the solution to this problem is dependent on how much water we actually spill.

The team did not address a few options that I think are more viable than the ones they proposed. One being to route the water from the FC&I to unit 5 penstock. The second is Martin's proposal or something similar. Build a device around one or two individual intake structures which would allow us to control the elevation of intake.

Comments by Martin Bauer

Concerning getting cooler water through the units. Consider just using unit 4 and unit 5 for temperature control. Modify unit 4 and unit 5 trashracks by:

1. Lowering them to minimum elevation 720 ft.

2. Modify the trashracks to be similar to Folsom's so that Plates could be placed (using slides) to get water from different elevations. Plates could be manuevered using <u>existing</u> Gantry crane.

The lowest elevation of the FC&I valves is 736 ft., Dwg. 214-D-711. The lowest possible elevation of the trashrack modification would be 720 ft., Dwg. 214-D-10852. This would allow 16 feet clearance above bottom of lake bed. Using movable plates would allow:

1. Release of proper temperature.

2. Avoid spilling water.

3. Generate power through either or both of two units.

4. Allow for more generation and flow than possible through FC&I valves.

5. Maintain the aesthetic appearance of Shasta.

6. Use existing structures and equipment to control water temperature.

7. Probably reduced O&M than for any other method since existing equipment is used.

8. The least modification and probably money involved (provided D&C doesn't work on it).

Comments by Bill Luce

1. If this study is used as a decisionmaking tool, the cost estimates must be presented in more detail, and the assumptions used to calculate annual costs should be presented.

2. The logistics of fabrication, installation, operation and maintenance of the various alternatives should be identified and evaluated in great detail, since some of the alternaties may present some problems that could add greatly to the costs.

3. Without the above information, I am afraid the study would be used to suport the most politically attractive alternative, the temperature curtain, and we would end up with a real nightmare to fabricate, install, operate and maintain.

# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Division of Ecological Services
2800 Cottage Way, Room E-1803
Sacramento, California 95825

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October 2, 1987

MEMORANDUM

TO : Phil Sharpe, Planning Officer, U.S. Bureau of Reclamation, Sacramento, California

FROM : Field Supervisor, Division of Ecological Services, U.S. Fish and Wildlife Service, Sacramento, California

SUBJECT : Shasta Dam Temperature Modification Value Engineering Study, September 1987

This is in reference to the draft report on water temperature modification alternatives presented at the Value Engineering Team meeting on September 25, 1987. We have reviewed the report and offer the following comments.

We commend the Bureau for vigorously pursuing water temperature control alternatives at Shasta Dam. In our opinion, this control capability is necessary to ameliorate significant losses of salmon production incurred by warm water releases. However, we do not view this as an enhancement action as described on page 2, but as a necessary mitigative measure to minimize water temperature problems that often exist below Shasta Dam in the late summer and fall period. This action is imperative to reduce losses of winter, spring and early spawning segments of the fall salmon runs.

We favor the installation of the curtain type temperature modification facility from the standpoint of the relatively short time it would take to have it installed and operating. However, we are concerned about its limitations, maintenance problems and potential for its failure if portions of the curtain were to drift into the intake structures. Therefore, we view the curtain as an interim measure to provide some improvement in release temperatures until permanent facilities can ultimately be provided. We prefer a permanent shutter arrangement with thrusters or use of the lower level outlets combined with installation of turbines to recover loss of potential power generation.

Thank you for the opportunity to attend the meeting and provide our comments. If you have any questions, please contact staff biologist Rick Morat at (916) 978-4613.

**If you haven't already, we highly recommend coordination with Mr. Gary Stacy of the California Department of Fish and Game in Redding, California.**

Jim McK

James J. McKevitt

cc: ARD, FWE, FWS, Portland, OR
Reg. Mgr., Reg. 1, CDFG, Redding, CA (Attn: Stacy)

UNITED STATES GOVERNMENT

# memorandum

DATE: September 28, 1987

REPLY TO ATTN OF: ACTING Chief, Division of Planning and Technical Services

SUBJECT: Shasta Dam Temperature Modification VE Study

TO: Regional Engineer, Attn: MP-270

We have reviewed the subject draft and offer the following comments:

1. Reaction turbines, such as shown on Figure 5, require that the discharge of the draft tube be submerged below minimum tailwater elevation. Since the river outlet pipes discharge above minimum tailwater we question whether the necessary hydraulic condition exists. Perhaps the condition could be set up within the outlet pipe downstream from the potential powerplant. If not, additional turbine generator units might be constructed on the left side of the dam and connected to the outlet pipes with a penstock. The small amount of time that a new unit would operate, either during times of temperature control or spills, probably would not justify the cost.

2. An alternative means of recovering the lost power potential might be cross connecting the lower level outlet pipes with one or more existing penstocks at the downstream face of the dam. This would avoid the need for additional turbine generator units.

3. Another possibility might be to bring water into the existing penstocks from a lower lake elevation either from the existing plugged diversion tunnel or a new conduit below the existing penstocks.

4. The draft states that the new units in the river outlets could be used for peaking generation during spill conditions. During a spill period any new units would operate continually. Therefore baseload power would be generated not peaking. If that option is viable, delete the work "peaking".

John H Turner

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